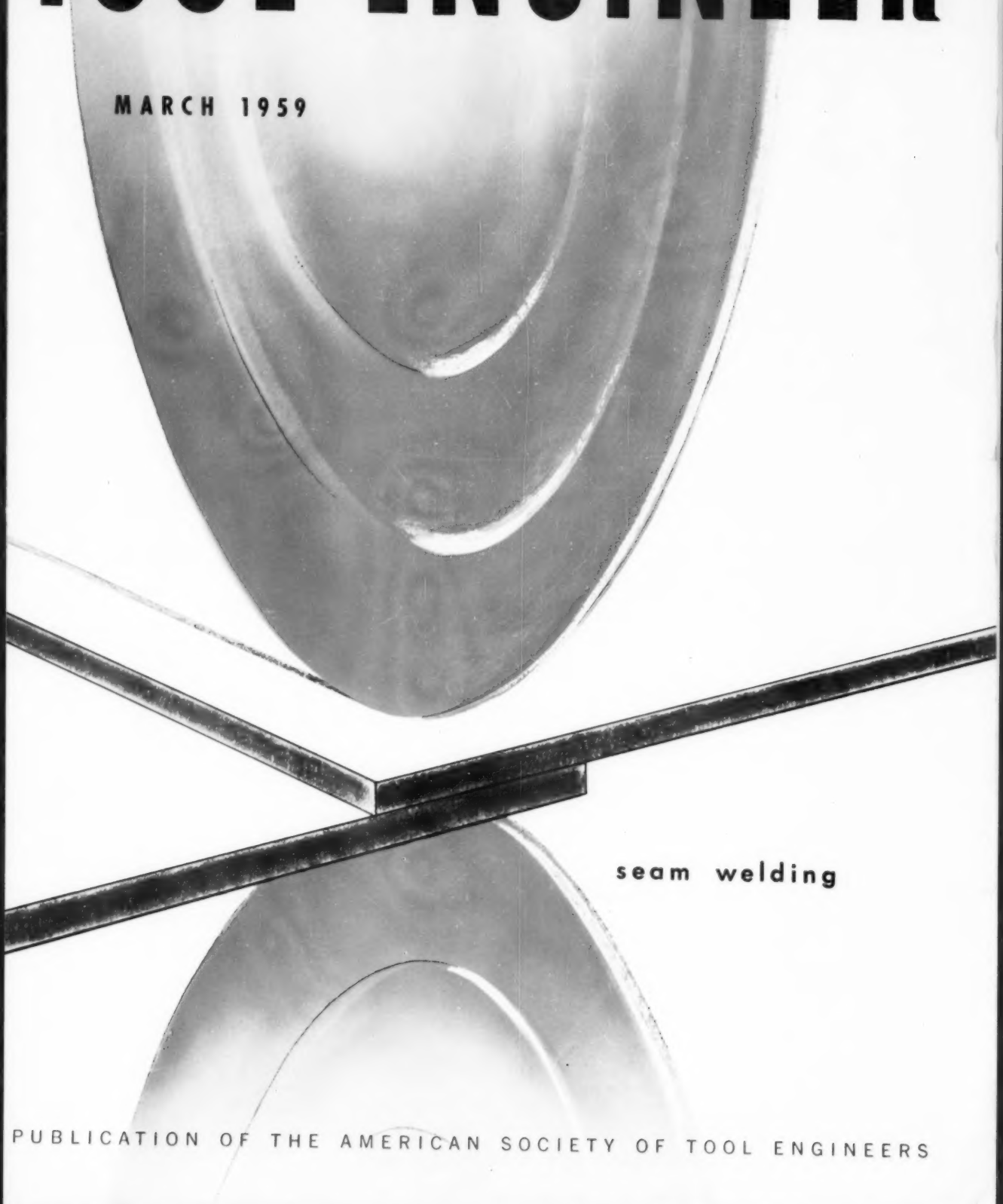
the

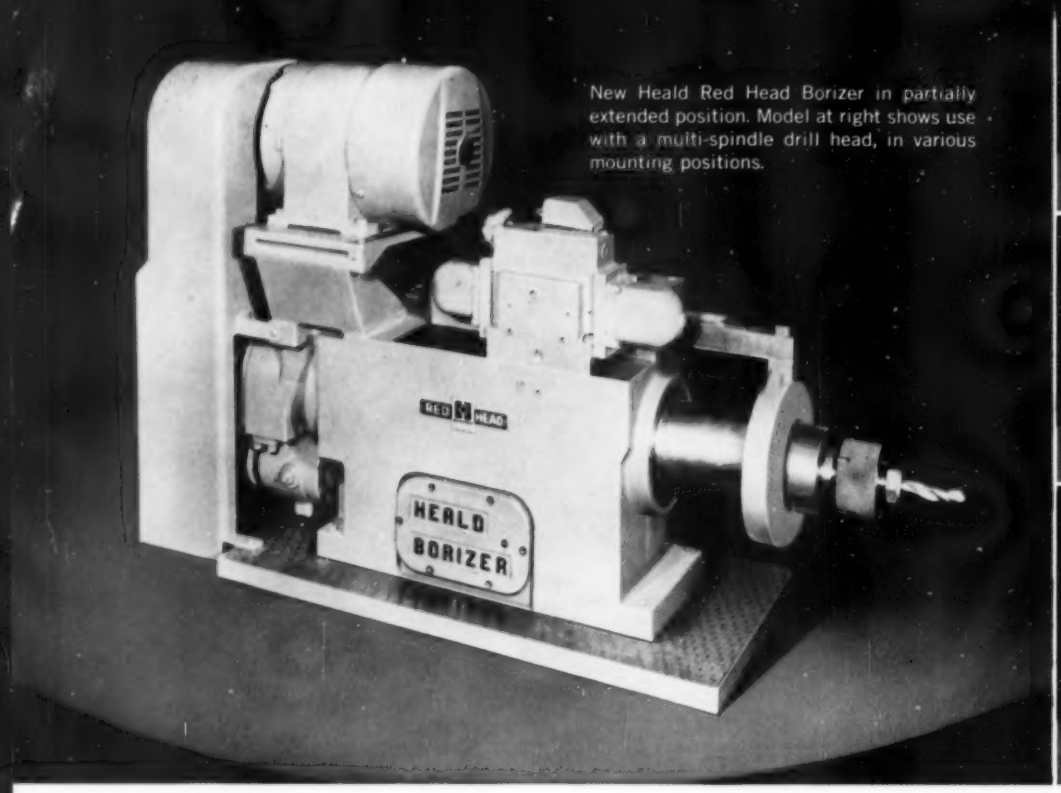
TOOL ENGINEER

MARCH 1959

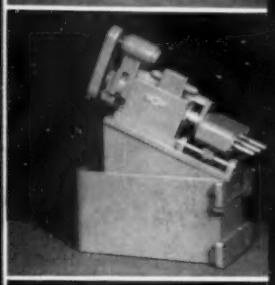


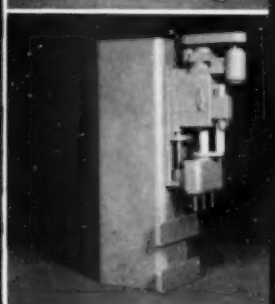
seam welding

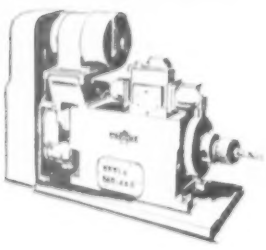
PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS



New Heald Red Head Borizer in partially extended position. Model at right shows use with a multi-spindle drill head, in various mounting positions.







Presenting the new Heald

BORIZER

Another **NEW** PRODUCT *by Heald*

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A completely self-contained unit for rotating and feeding single or multiple tools in automated setups

Designed primarily for driving multiple-spindle drill units, it rotates tools and can supply its own hydraulic power. It feeds tools in to the work at any desired rate and rapid traverses out when the operation is done. In short, the new Heald Red Head Borizer can do just about any drilling, reaming, counterboring, chamfering, and plunge facing operations. Under conditions consistent with its design and purpose it is also capable of boring operations similar to those performed on Heald Bore-Matics.

Its compact design permits grouping a number of units in a variety of positions on a single base machine or along an automated line. And its compact, self-contained construction simplifies relocation for job changeovers. Note also that this unit can be mounted horizontally, vertically or at any desired angle.

Heald Red Head Borizers incorporate the basic design and specifications of precision Red Head Boringheads and are available in four sizes, with strokes of 8, 10, 12 or 15 inches. An adequate thrust range is available for multiple drilling operations. Easily accessible dogs control cylinder stroke and adjustable valve gives infinitely variable feed rates within the feed range. The unit may be operated with integral or central hydraulic systems or with integral or centralized electrical controls.

Ask your Heald engineer for further details, or send for a copy of Bulletin No. 5-2, Issue 1.

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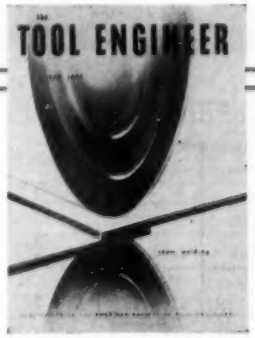
the tool engineer

Vol. 42, No. 3 March 1959

THIS MONTH'S COVER

Seam welding is a fast and efficient method for joining stainless steels where a uniform, leakproof joint is mandatory. This and other methods for joining these versatile materials are covered in an article starting on page 119. William Solms is the cover artist.



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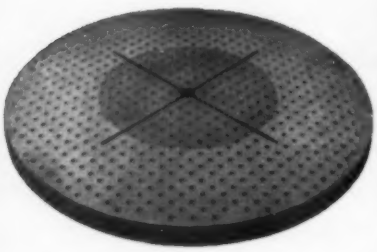
Cylinder wheels for use on most popular types of vertical spindle grinders



Combination grade and face with radial lines for even wear and better coolant distribution

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range of disc sizes

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regular disc	10″ to 48″	1″ to 3″
segmental disc	53″ to 84″	1″ to 3″
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THE TOOL ENGINEER is published monthly, except semimonthly in June, in the interest of members of the American Society of Tool Engineers. Entered as second class matter, November 4, 1947, at the post office at Milwaukee, Wisconsin, under the act of March 3, 1879. Yearly subscriptions: members, $2.00; nonmembers, $6.00; Canada, $6.50, and all other countries, $8.00.

Professionalism

Professionalism has grown to be a way of life, especially with respect to ethics and to a man's code of conduct at his work. Occasionally, the word professional is construed to apply only to those engaged in the learned professions of doctor, lawyer and minister. Such restrictions, however, have yielded to our modern way of life. Seldom is this classical definition encountered in our industral economy.

More lately, state laws for professional registration of engineers have tended to put other restrictions on professionalism. To many, it is restricted to those who have licenses to practice engineering.

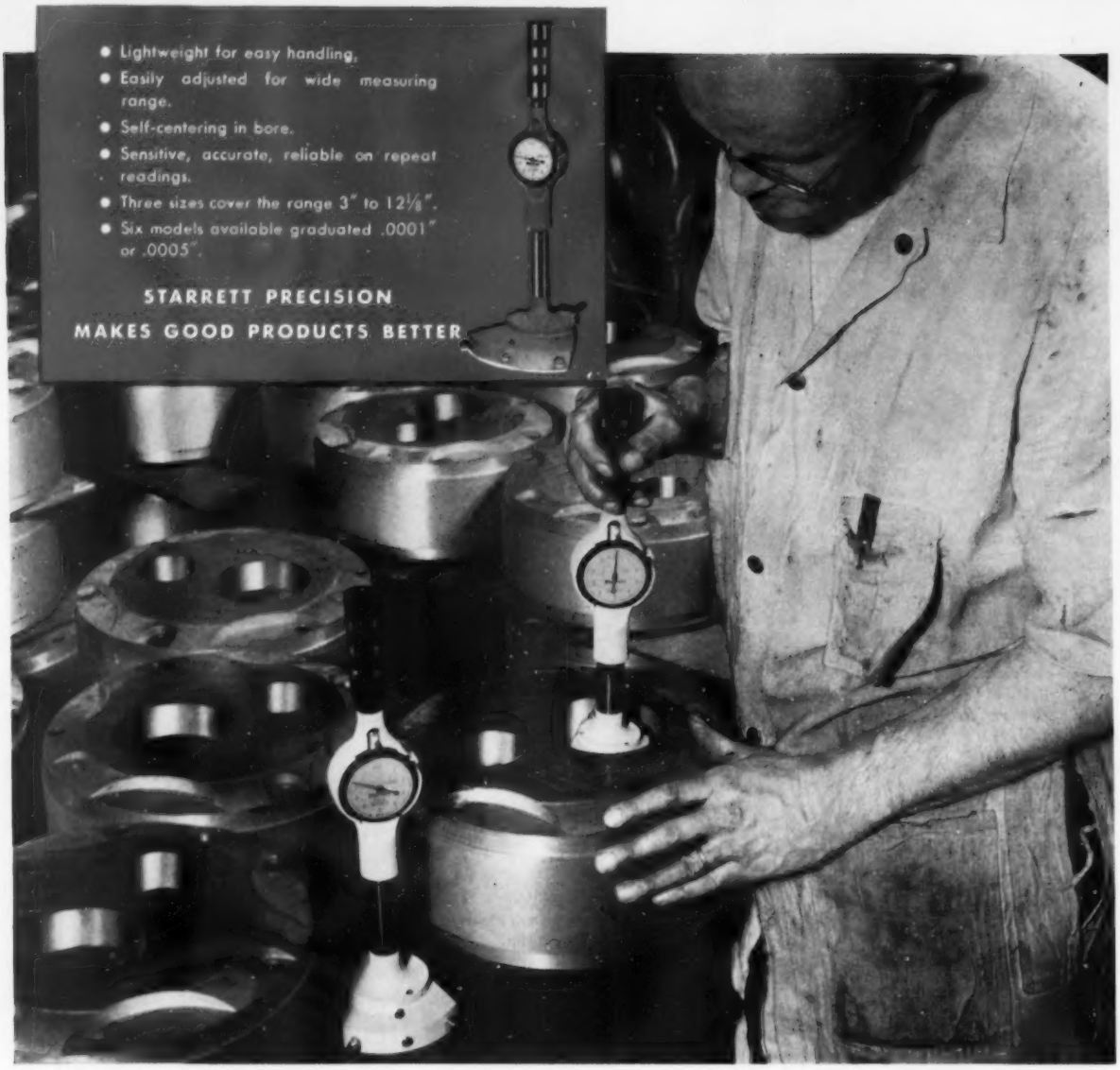
Because engineering is one of the younger professions and because many engineers—qualified from practice and experience—do not appreciate the professional aspects of their work, much confusion and misunderstanding cause differences of opinion that divide those with common interests. Another difficulty stems from the word "engineering" itself. It has been used to mean many types of occupation, including the operator of a train.

In recent years, engineer and scientist have been surrounded with a halo of purity and public acceptance. As a result, the title is misused deliberately for nonengineering functions as a passkey to gain admittance to offices that may otherwise be barred. At the other extreme is the force of state laws for registration restricting the use of the word "engineer" to one who has passed a state examination.

Extremely practical, however, is the Taft-Hartley Law that defines an engineer as a man who from specialized training and experience can make decisions based upon related engineering information.

John W Greve

EDITOR



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Three sizes of these new Starrett No. 84 Series Dial Bore Gages will handle all bore diameters from 3 inches to 12⅛ inches (3"-5 3/16", 5"-8⅛", 8"-12⅛"). Available with Starrett high precision-low friction Dial Indicators reading in ten-thousandths or half-thousandths. Range screw, gaging contact and centralizing plungers normally furnished in hardened and tempered tool steel. Also available carbide tipped on special order.

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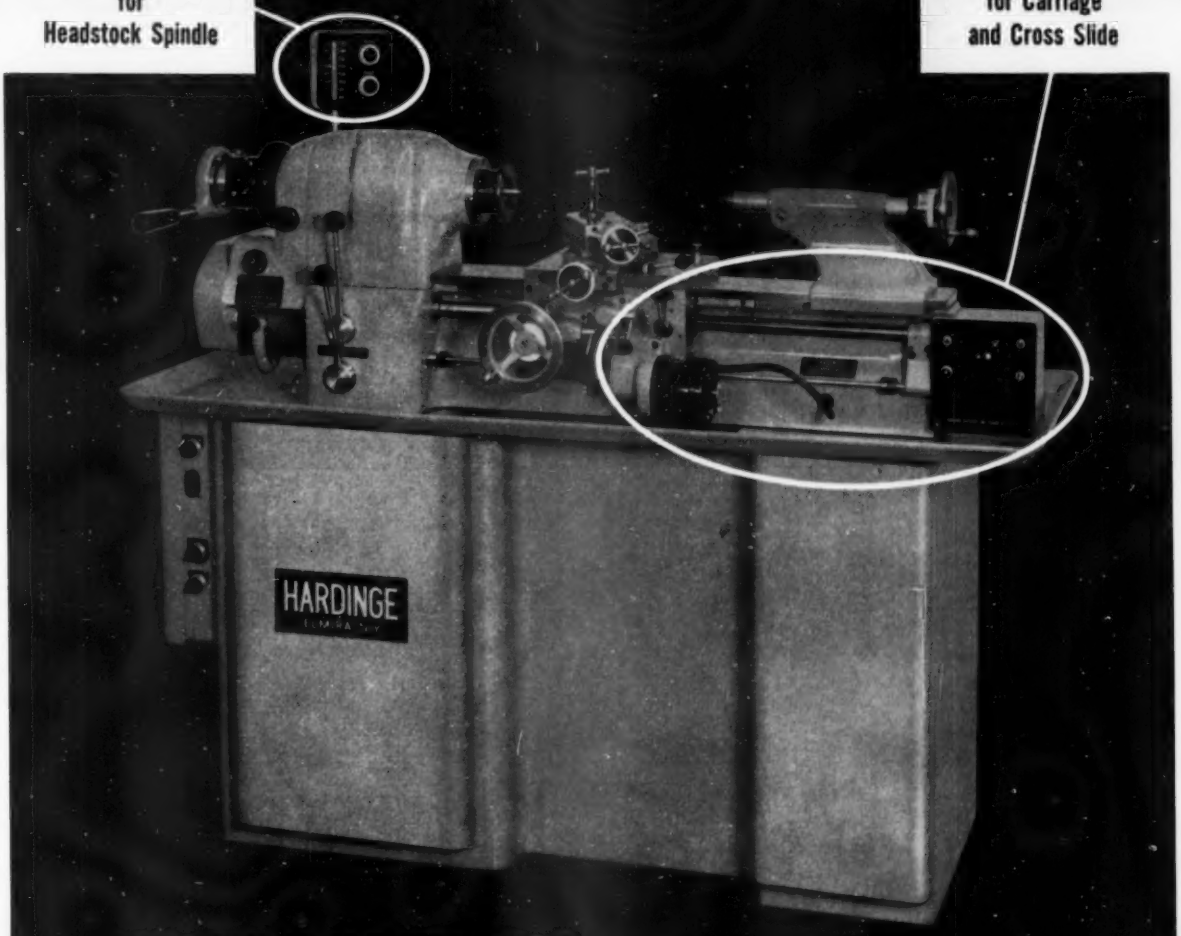
Variable Speed Drive for Headstock Spindle

Variable Feed Drive for Carriage and Cross Slide



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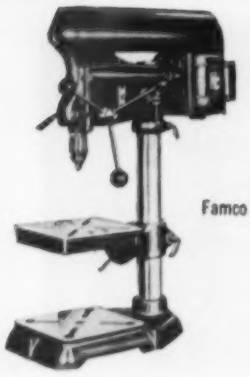
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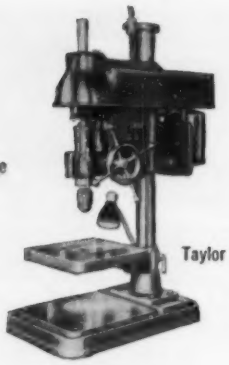
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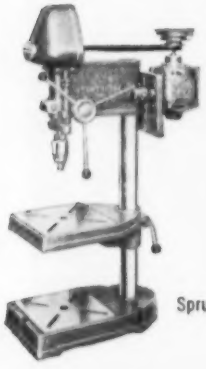
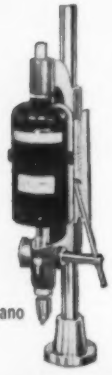
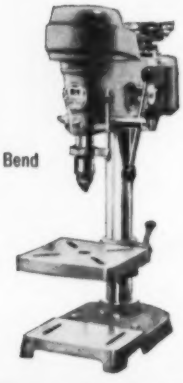

Sprunger


Delta


Electro-Mechano


South Bend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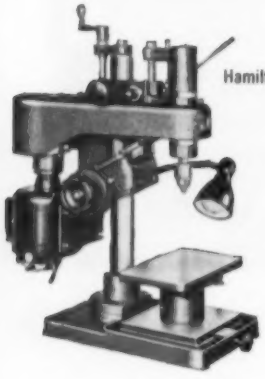
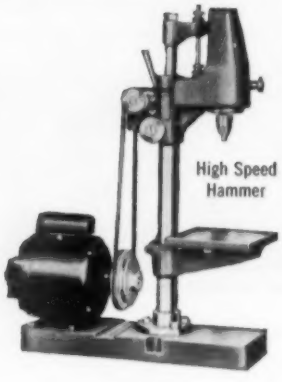
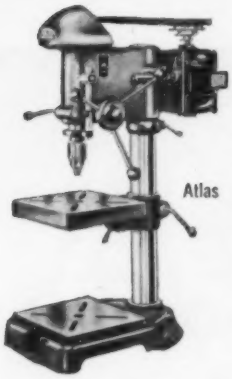

Hamilton


High Speed Hammer


Shop Smith


Sigourney


Atlas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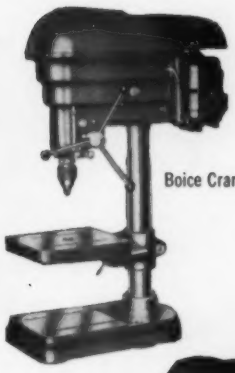
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POPE P-18670 Heavy Duty, High Speed Milling Spindle, 4 ft. long, 10 in. dia.; weight about 1000 lbs.

POPE P-18844 Vertical Bearing Grinder Spindle, 20 HP, 6 ft. long, 12 in. dia. barrel; weight approx. 4000 lbs.

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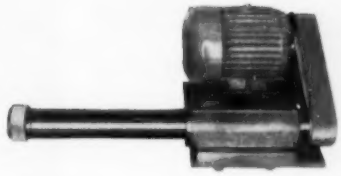
POPE P-18842 Deep Hole Internal Grinding Spindle, 10 HP, 7 ft. long, 12 in. dia. barrel; weight 4000 lbs.

POPE P-1098 Heavy Duty Internal and External Grinding Spindle, 50 HP, for wheel of 30 in. dia. and 12 in. width; weight approx. 6000 lbs.

POPE P-A1 Deep Hole, Ram Type Grinding Spindle attached to boring machine, 10 HP, 10 ft. long, 10 in. dia. barrel; weight 2000 lbs. (For purposes of comparison, a Pope P-32 6″ x 18″ Surface Grinder Spindle is shown in the foreground.)



POPE P-5794B Motorized Deep Hole Grinding Spindle, 10 HP, 36 in. long, 6 in. dia. barrel, for use in horizontal or vertical position on boring mills or planers; weight about 800 lbs.

POPE P-10009E Motorized Deep Hole Grinding Spindle, 5 HP, 36 in. long, 5 in. dia. barrel; weight 600 lbs.

Send us your specifications and get prompt quotations on the one best Spindle for your work, out of the 20,000 different Precision Spindles that bear the name "POPE".

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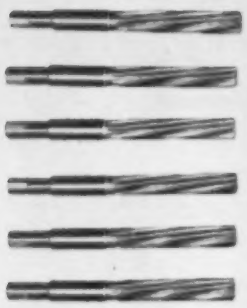
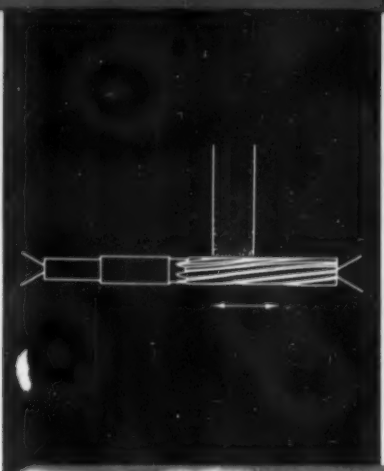
Production increased 90%

New Landis 4" x 18" type H Plain Grinder





production data

Machine:	New Landis 4" x 18" type H Plain Grinder
Part:	Standard size reamer
Operation:	Grinding standard size reamers to selective sizes
Production:	35 per hour roughing 105 per hour finishing
Material:	High speed steel
Hardness:	61-63 Rockwell C
Stock removal:	Rough—.012"-.014" Finish—.001" with 12 to 18 RMS finish
Tolerance:	.0001"

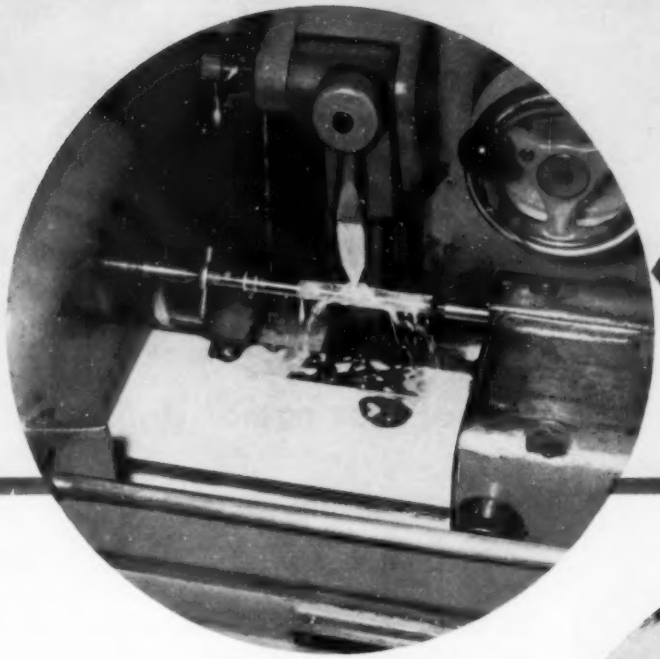
Landis 4" x 18"
type H Plain Hydraulic Grinder

LANDIS TOOL COMPANY

230

grinding reamers

replaces old machine, cuts grinding costs



Close tolerances of .0001" are consistently maintained grinding the flutes of these stock reamers to selective sizes.

Stock removal is fast, and sizes accurate with this compact Landis grinder. Convenient Landis eye-level wheel feed makes selective size adjustments fast and accurate.

WAYNESBORO, PENNSYLVANIA

LANDIS

precision grinders

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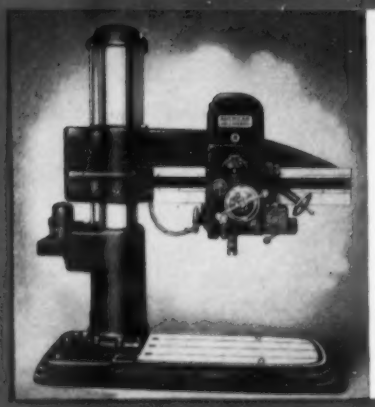
Are you really putting your small radial drills to work...OR... are they just drilling machines



If they are "AMERICAN" Hole Wizards they are DRILLING...TAPPING and BORING MACHINES

...not just radial drills!

To further improve their boring qualities the new "AMERICAN" 9 inch and 11 inch column Hole Wizards now may be equipped with a FINE FEED BORING ATTACHMENT.

This attachment, furnished in addition to the standard feeding mechanism, merely by the flip of a lever reduces the standard feed range 75 per cent.

The fine boring feeds thus provided are the answer to precision boring on radial drills. Many tool and die shops are already using them for high precision, fine finish boring of jigs and fixtures.

And don't overlook the advantages of the Hole Wizard's Helical Gear—Lo-Hung Spindle Drive —NITRIDED SPINDLE AND SLEEVE—TIMKEN MOUNTED WITH OUTSIDE ADJUSTMENT FOR SPINDLE BEARINGS.

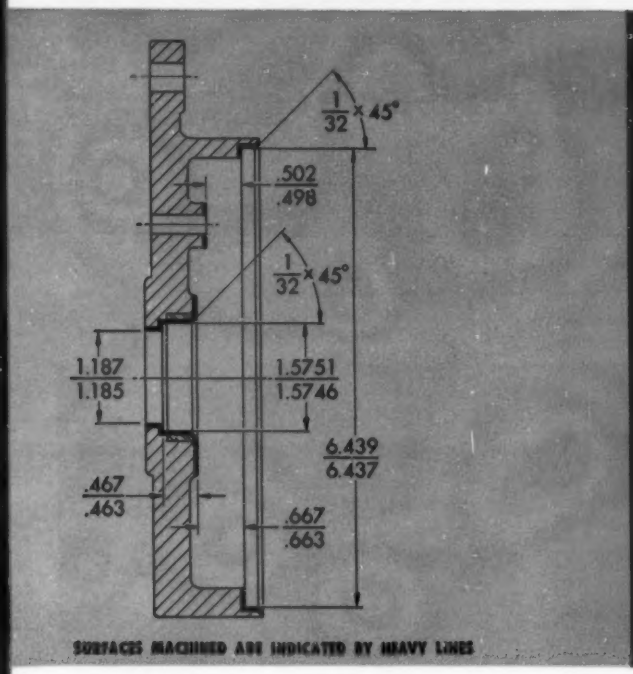
These exclusive "AMERICAN" features permit putting your radial drills to work at a profit.

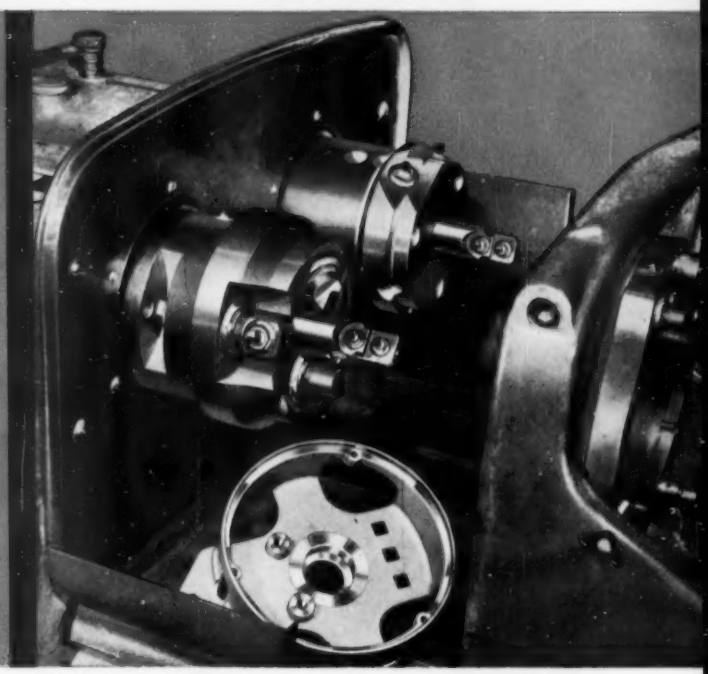
• ***Ask for bulletin No. 325 and get all the facts.***

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

9 surfaces rough and finish machined in 2 passes...





HOW MICROBORE CLUSTER TOOLING DOES IT ON A PRECISION BORING MACHINE!

Special Microbore Cluster Tooling makes it possible for a leading electrical equipment manufacturer to obtain a continuous flow of finished parts by rough and finish machining, simultaneously, nine surfaces on a generator end bell casting in two passes.

SET-UP TIME IS FASTER, TOO—Independent, precision adjustment of each tool point permits accurate settings in a matter of seconds. Speed and accuracy of adjustment, plus compactness of Microbore units, makes cluster tooling practical to a degree formerly considered impossible.

Microbore is a versatile tool with unlimited application for all types of boring, turning and facing operations. Microbore Standard Boring Bars, Boring Bar Sets and Flash-Change tooling complete the perfect combination for accurate, quick change tooling.

***To find out how Microbore can help you, write for our new catalog No. 58.**

DeVlieg Microbore System

DE VLIEG MICROBORE • DIVISION OF DE VLIEG MACHINE COMPANY

Fair Street • Royal Oak, Michigan

This valve gets a leak-proof seal from a Blanchard Surface Grinder

"The Blanchard Surface Grinder is one of the most important improvements in our modernization program." This report comes from the Commercial Refrigeration Division of Bendix-Westinghouse Automotive Air Brake Company—makers of power and condensing units for refrigeration equipment.

The Blanchard No. 18 Surface Grinder puts a surface of 5 micro inches or better on Bendix-Westinghouse valves at the rate of 75 pieces an hour.

A Blanchard Model 18 Surface Grinder is used to finish grind valve plates used in Bendix-Westinghouse electric refrigeration compressors. They say: "This operation is very important, because—with a surface finish of five micro inches or better—we get a perfect seal on our gaskets and valves, eliminating the possibility of leakage."

Is there room for improvement in *your* surface grinding? For best results...

Write today for your free copy of "Work done on the Blanchard," fifth edition, and "The Art of Blanchard Surface Grinding," fourth edition.

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***First* with piloted taps . . . . . .**

***First* with TCI taps (for cast iron) . . . . . .**

***First* with interrupted thread taps as standard . . . . . .**

NOW Threadwell introduces the revolutionary new TURBO-CUT TAP

- **Maximum chip removal**
- **Utmost accuracy**
- **Reduced tap breakage**
- **Ideal for ductile materials**
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- **Excellent in deep holes**

Look at the proven performance:

FIELD TEST #1
Midwest Manufacturer of Tapping Units
Part: Aluminum grommet drilled to a depth of ½"
Operation: Tapping ⅜" deep
Production: 70 pieces/minute
Result: 18,000 holes tapped with one #10-24 "Turbo-Cut" Tap and *still usable.*

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Part: Polystyrene bathroom accessory
Operation: Tapping
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PRODUCTION POINTERS from GISHOLT

More cost-cutting IDEAS– to help you

BODINE ELECTRIC CUTS TIME 65% WITH THIS SETUP

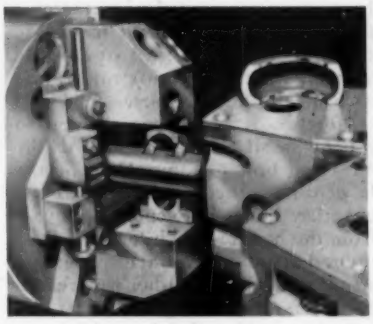
Automatic drive, smart tooling on No. 3 ram cut time and costs

Here are several production ideas you may find useful in your work. Bodine Electric, a well-known manufacturer of fractional h.p. motors in Chicago, Ill., has applied them on two Gisholt MASTERLINE No. 3 Ram Type Turret Lathes—cutting machining time an average of 50% on eight different parts. Gross production totals more than 80,000 units per year.

Replacing four obsolete turret lathes, both No. 3 rams are equipped with hydraulic drives that control all machine functions, including selection of speeds and feeds, reverse feed, stop and reverse of spindle, etc. The hydraulic drive actually converts the hand-operated turret lathes into AUTOMATIC CHUCKING TURRET LATHES, permitting one operator to handle both machines. Other plus factors include longer tool life and more uniform quality through use of correct speeds and feeds.

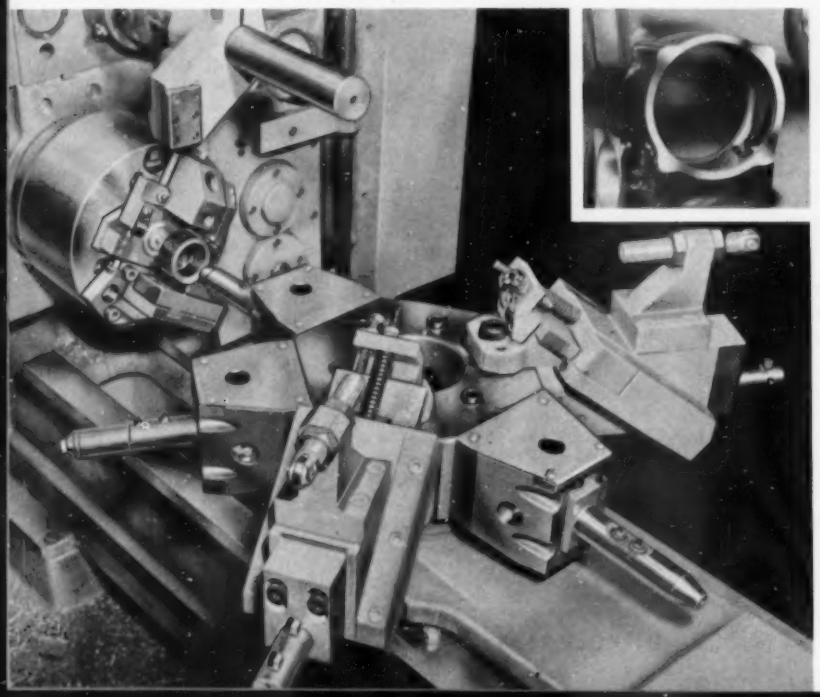
On the typical cast iron worm gear housing shown, time was cut 65% on the boring and facing operation alone. Parts are held in a 10", 2-jaw, air-operated fixture. A manually operated swinging stop mounted on the fixture face is used for length location and then moved out of the way after the part is chucked to provide clearance. The automatic cycle is started and the operator moves to the second machine while hex turret tools rough- and finish-bore, straddle-face and chamfer at the front and back, and bore a relief between the front and back bores. F.t.f. time, 2.5 minutes.

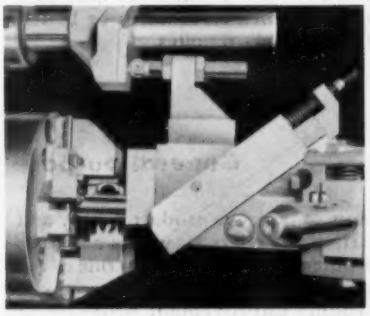
Automatic cycle controlled by hydraulic drive cuts time 65%, doubles operator productivity. Smart tooling eliminates "cutting air" and improves accuracy by machining front and back of work simultaneously.



Special pivoting boring bars are used for rough- and finish-boring. As hex turret feeds forward, tapered end of boring bar enters straight bore of chuck pilot bushing. This raises pivoted bar aligning it with machine centerline and positions tools vertically to machine front and back bores simultaneously. Runout between 2¾" diameter front and back bores is held within .0015" with this method. Relief between front and back bores and front chamfer is also handled in this manner on another turret station.

Hydraulic drive and special hex turret tooling simplify and speed machining, assure greater accuracy, concentricity and parallelism between front and back faces. (Inset) Close-up of worm gear housing showing surfaces machined in 2.5 minutes f.t.f.





Automatic slide tools used for rough and finish-straddle-facing front and back, and chamfering back I.D. On forward feed of hex turret, a roller on movable slide contacts a dead stop bracket on overhead pilot bar. Slide is forced up incline on continued forward feed of hex turret, engaging tools that straddle-face front and back simultaneously. Reverse feed on finish cut provides required smooth surface finish.

GISHOLT

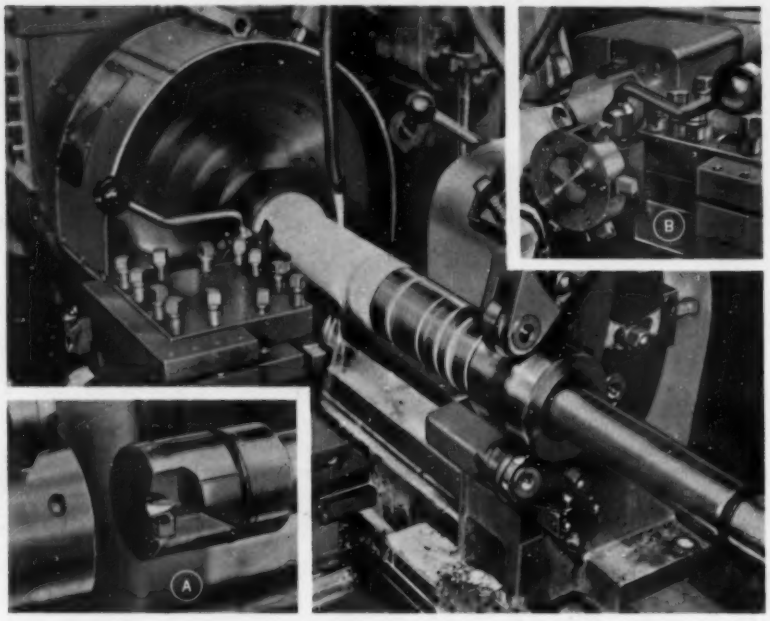
SETUP SAVES BAKER OIL TOOLS $30,000 PER YEAR

Smart tooling on MASTERLINE 3L Saddle Type Turret Lathe cuts time 25%

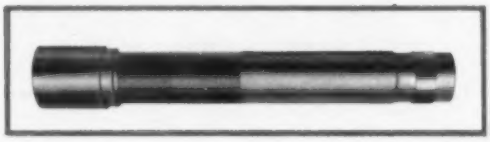
You will want to study this setup used by Baker Oil Tools, Inc., Los Angeles, Calif. It saves over $30,000 per year in the machining of centrifugally cast, iron retainer production packer bodies.

Several "extras" contribute to the dramatic saving: an indexing tool holder on the square turret, with six preset tools; special gun drilling and burnishing tools on the hex turret; a full-length lead screw for threading from either turret; an open-side steadyrest support for maximum accuracy in the long bore.

Here's how these "extras" are used on the small, 3½" O.D. end of the 31"-long body, shown. Held on the large-diameter end, the small bore is chamfered, then live center supported from the hex turret while the O.D. is turned from the square turret for steadyrest support. Other square turret tools, including those on the indexing holder, finish-machine the outside diameters, face the end and, using the lead screw threading attachment, cut an 8-pitch V-thread near the small end and an 8"-long, .015"-deep, 16-pitch buttress thread near the large end. During finish-threading, the gun drill removes ¼" stock per side, taking the rough cast hole to within .001" of finished size in one pass. The roller burnishing tool sizes and finishes the bore to a 32 micro-inch RMS finish or better. Time f.t.f., 41 minutes.



Preset tools on indexing holder complete O.D. turning while gun drill works in bore. (Inset A) Gun drilling head. Cutter life is 200 pieces per grind. (Inset B) Each preset tool on indexing tool holder has cutting life of 400 pieces.



Completely machined retainer production packer body. Used in oil and gas wells at depths to three miles or more, with pressures up to 10,000 p.s.i. and temperatures over 300 degrees.

Setup saves over $30,000 per year. Simultaneous use of hex and square turret tools, plus indexing tool holder, cuts time 25%. Gun drilling and burnishing tools eliminate boring, reaming, and subcontracted honing.

DoALL SUPERFINISHES TO IMPROVE PRODUCT QUALITY

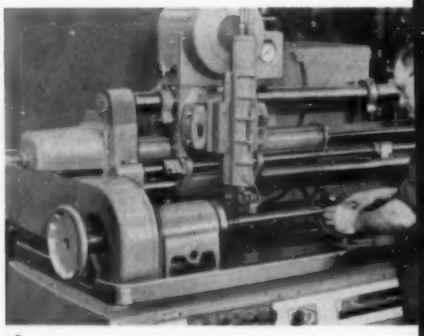
General-purpose 52A Superfinisher handles wide range of parts

How to improve product quality and still hold costs down is a major problem. Superfinishing is one of the answers. It is now part of a continuous product improvement program at The DoALL Company, Savage, Minn. Many components used in DoALL's line of machine tools, including band machines, surface grinders and others, are now being Superfinished.

Here's how the seal surfaces on piston rods used in hydraulic cylinders are improved by Superfinishing. Formerly the piston rods were ground to a 16 RMS surface finish, polished and chrome-plated. Still, some leakage took place past the rod seals.

Partial Superfinishing revealed grinding defects such as lobes and chatter. Now these defects are eliminated by grinding to a 30-50 RMS finish and then Superfinishing to a "controlled" 7-8 micro-inch RMS finish. All of the piston rods are now Superfinished, although in some cases it is restricted to the rod-seal area.

Superfinishing eliminates polishing prior to chrome-plating. Savings balance cost of Superfinishing operation. Improved rod surface gives longer seal life, eliminates field reports of leakage at seal.



Superfinishing improves product quality, provides better performance and reduces maintenance costs. Here the operator checks the final O.D. dimension on finished part.

GISHOLT

ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT

GREENLEE BALANCES FOR MAXIMUM QUALITY WORK

31S Balancer measures and locates unbalance on wide variety of high-speed parts

Looking for a quick, accurate way to get vibration-free performance from high-speed rotating parts or assemblies? Check this setup used by Greenlee Bros. Company, Rockford, Ill.

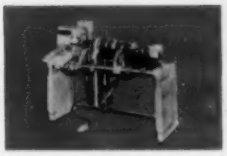
The 31S handles a variety of high-speed spindles, boring units, cutter head rotors, etc., used on Greenlee's well-known line of woodworking equipment and machine tools. Job-lots range from one to 15 pieces, weights up to 300 pounds.

A special cradle fixture is used with bushing inserts to handle variations in length and diameter.

A cope unit arbor for the Greenlee No. 545 Double End Tenoner Woodworking Machine is a typical part. It operates at sustained speeds of 3600 to 7200 r.p.m., and performs such delicate operations as shaping panels and coping. Balancing eliminates vibrations that cause imperfections on the finished wood surfaces.

The arbor is placed in the cradle and is belt-driven. The strobe lamp and amount meter show the exact angle and amount of unbalance in each correction plane—indicating exact drill depth required for correction. F.t.f. time, just four minutes.

Unbalance in each correction plane is corrected within the specified tolerance on a drill press. Only minimum spot-checking is needed to inspect for balance since the 31S has proved consistently that correction can be made within the specified tolerance on the first try.



31S Balancer with extra-length bed and cradle fixture handles short or long parts on job-lot basis. Note strobe lamp and direct reading amount meter, in same visual plane, permitting operator to observe angle and amount of unbalance simultaneously.

The 31S is ideal for fast, accurate job-lot or production balancing. Features quick setup, ample capacity and ease of calibration, permitting unbalance measurement in terms of correction methods used.

Cope unit arbor for Greenlee No. 545 Double End Tenoner Woodworking Machine. Note correction for unbalance made by drilling at observed angle to indicate depth in bushings (encircled) to left and right of armature body.

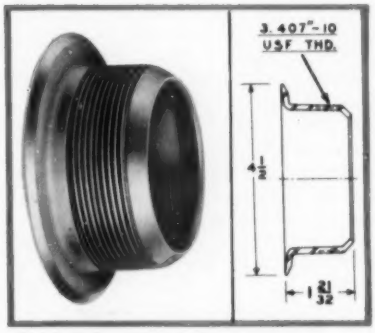
HOW CRI-DAN SOLVES A TOUGH THREADING PROBLEM

Single-point threading saves time, cuts tool and material costs

Want to turn your costly, troublesome threading jobs into money-saving operations? Then study the time-saving advantages of this setup on a CRI-DAN Model "B" Semi-Automatic, Single-Point Threading Machine.

The job: cutting a 3.407"-diameter, 10 TPI thread on a 303 stainless steel sink mounting flange used in home garbage disposal units. Work is held in the I.D. by a 3-jaw, 6" air chuck. Full-contour type chuck jaws, taper-turned to conform to the draft angle of the stamping, minimize possible distortion. No coolant is required as a single-point carbide threading tool, held in a heavy-duty tool block, makes 18 fast, automatic passes, completing the job in just 42 seconds.

The job was formerly handled on a thread milling machine but heavy cutting pressure required the use of heavy gage steel to prevent flexing.



The CRI-DAN single-point tool threading method reduces cutting pressure, so lighter gage stock is suitable—cutting material cost. Tooling costs are cut because a single-point carbide tool replaces a thread milling cutter. Maintenance cost is also low as the single-point tool produces more than 95 pieces between grinds.

Workpiece and drawing showing threading performed in 42 seconds. Savings in time and tooling costs alone are more than enough to justify the purchase of the CRI-DAN "B" machine.

CRI-DAN features inexpensive, single-point carbide tooling, semi-automatic operation for low-cost, high-production threading; provides more accurate lead and thread form on all types of internal or external threading operations.

MASTERLINE GISHOLT SINCE 1887

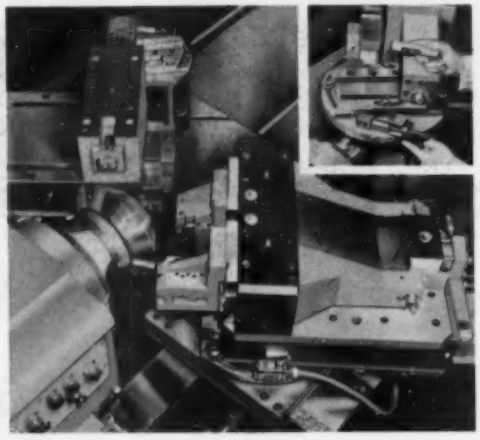
HARNISCHFEGER CUTS TIME 30% ON 27 BEVEL GEAR SIZES

Swivel base slides, gage bushings speed setups on No. 24

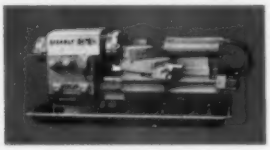
Interested in cutting angular machining costs where stock removal is heavy and tolerances are held to "minutes"? This setup, used by Harnischfeger Corporation, Milwaukee, Wis., will show you how.

Here one basic setup on a Gisholt MASTERLINE No. 24 Automatic Chucking Lathe handles 27 sizes of steel bevel gear blanks. Machining time is cut an average of 30%. Back angles, front counterbores and faces are machined, and sharp O.D. corners are broken, by straddle tools in two special blocks on the front independent slide. The blocks swing open for tool relief. At the same time, the face cone angles are generated by a cam-controlled tool in a sliding holder on the rear independent slide. F.t.f. time on the typical 12¾"-diameter, 5½"-wide part shown is only 7½ minutes.

Special tooling reduces setup time. *Expanding mandrel* holds work in bore, drives with key or against back lug. Eight mandrels handle all parts; bushings compensate for diameter changes. *Front carriage top* adjusts for fast transverse settings. *Independent slide* with swivel base mounts on carriage top and supports straddle tool blocks. *Independent slide* on rear carriage has swivel base. It supports special tool block with sliding tool holder, which is controlled by cam plate on angularly adjustable pedestal mounted on rear carriage top. *Gage bushings*, clamped between positive stops and swivel bases on independent slides, assure quick, accurate angular settings.



Completed part on mandrel, straddle tools on front independent slide, and face cone angle generating tools on sliding tool holder in block on rear independent slide. (Inset) Operator holds gage bushing, indicates how it slips on threaded shaft attached to swivel base. Shaft swings between swivel base and positive stop. Nut is tightened from opposite side to complete angle setting.



Master gage bushings, swivel bases on independent slides and pedestal-mounted cam plate plus adjustable front carriage top cut change-over time 15%. Fast, automatic cycle provides maximum stock removal, highest efficiency.

HOW YOU CAN SAVE TIME AND CUT COSTS ON FIXTURE WORK

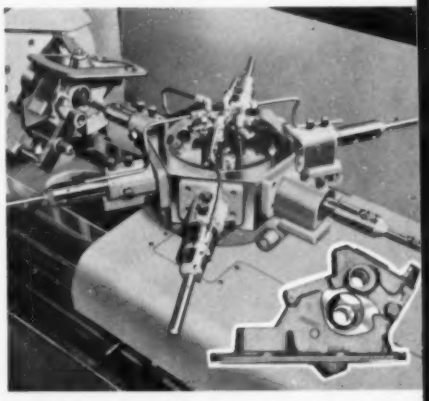
Fixture on double-tooled automatic turret lathe speeds and simplifies job

How much could you save on your odd-shaped parts requiring special holding fixtures if you used automatic cycle machining?

This setup on a Gisholt 2F Fastermatic Automatic Chucking Turret Lathe which is cutting time 25% on a tough boring operation may give you some ideas. It is used by a large automotive parts manufacturer to machine cast iron tractor steering gear housings. Work quality and tool life have been improved and automatic cycle permits the operator to handle a second Fastermatic.

A counterbalanced fixture is used, with a special arbor for center location in two bores, and a dead stop for length location against a milled face. Manually operated clamps hold the work. Piloted boring bars on hex turret stations 1, 2 and 3 rough, semi-finish, finish-bore and chamfer a 2¾"-diameter bore at the front and a 1¼"-diameter bore at the back. The back bore is also shave-faced. Micro-bore tools, used on hex 3, are so arranged that the front bore is completed just as the lead tool begins to finish the back bore. Rigid piloted tooling, plus separate finishing cuts, minimizes deflection and permits holding a .0005" tolerance in the back bore. Time f.t.f., only 3.5 minutes.

A duplicate set of tools on hex turret stations 4, 5 and 6 permits finishing two parts with each complete index of the hex turret. No time is lost indexing past idle stations and twice the usual number of parts is finished between tool changes.



Special fixture speeds handling of odd-shaped cast iron tractor steering gear housing shown. Piloted finish-boring tools machine front and back bores separately to hold .0005" tolerance in back bore.

Special fixture speeds work-handling. Double-tooled hex turret minimizes non-productive time. Automatic cycle permits operator to handle second Fastermatic.

No. 3-459
730

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Printed in U.S.A.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Machines • Packaging Machines • Masterglas Molded Plastic Products

BATH Tap'n Gage TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 3

Subject: Thread Series, Symbols and Suggested Applications:

Thread Series Identification

Thread series are groups of diameter-pitch combinations distinguished from each other by the number of threads per inch applied to a specific diameter. There are six standard thread series. They are the coarse thread, fine thread, extra fine thread, 8 thread, 12 thread and 16 thread series.

Coarse Thread Series

Thread sizes of this series that are recognized as Unified are designated by the symbol "UNC" and all others by "NC". The coarse thread series is suitable for bolts, screws, nuts and general use where the wall thickness will accommodate the thread dimensions. It is particularly advantageous for applications requiring rapid assembly or disassembly or for threading into lower-strength materials, such as castings, soft metals and plastics.

Fine Thread Series

Thread sizes of this series that are recognized as Unified are designated by the symbol "UNF" and all others by "NF". The fine thread series is suitable for bolts, screws and nuts, and other applications where a closer ratio is desired between the static strengths of the bolt and thread; where length of engagement is limited; where a smaller lead angle is desired, or where the wall thickness requires a smaller thread. Caution should be observed when using this series in castings, soft metals, plastics and similar lower-strength materials.

Extra Fine Thread Series

Thread sizes of this series that are recognized as Unified are designated by the symbol "UNEF" and all others by "NEF". The extra fine thread series is applicable where thin walled material is to be threaded; where thread height of nuts clearing ferrules, coupling flanges etc., must be held to a minimum and where a maximum practicable number of threads is required within a given thread length.

8 Thread Series

Thread sizes of this series are designated "8N" and in certain cases are recognized as Unified. The 8 thread series is a uniform-pitch series for large diameters. Originally intended for high-pressure-joint bolts and nuts, it is now widely used as a substitute for the coarse thread series for diameters larger than 1 inch. It is used particularly in bolts for high pressure pipe flanges, cylinder head studs and similar fasteners against pressure.

12 Thread Series

Thread sizes of this series that are recognized as Unified are designated by the symbol "12UN" and all others by "12N". The 12-thread series is a uniform-pitch series for large diameters requiring threads of medium-fine pitch. It is widely used in machine construction for thin nuts on shafts and sleeves.

16 Thread Series

Thread sizes of this series that are recognized as Unified are designated by the symbol "16UN" and all others by "16N". The 16-thread series is a uniform-pitch series for large diameters requiring fine-pitch threads. It is suitable for adjusting collars and retaining nuts and other fine-pitch applications.

Unified and American, Screw Thread Standard Series

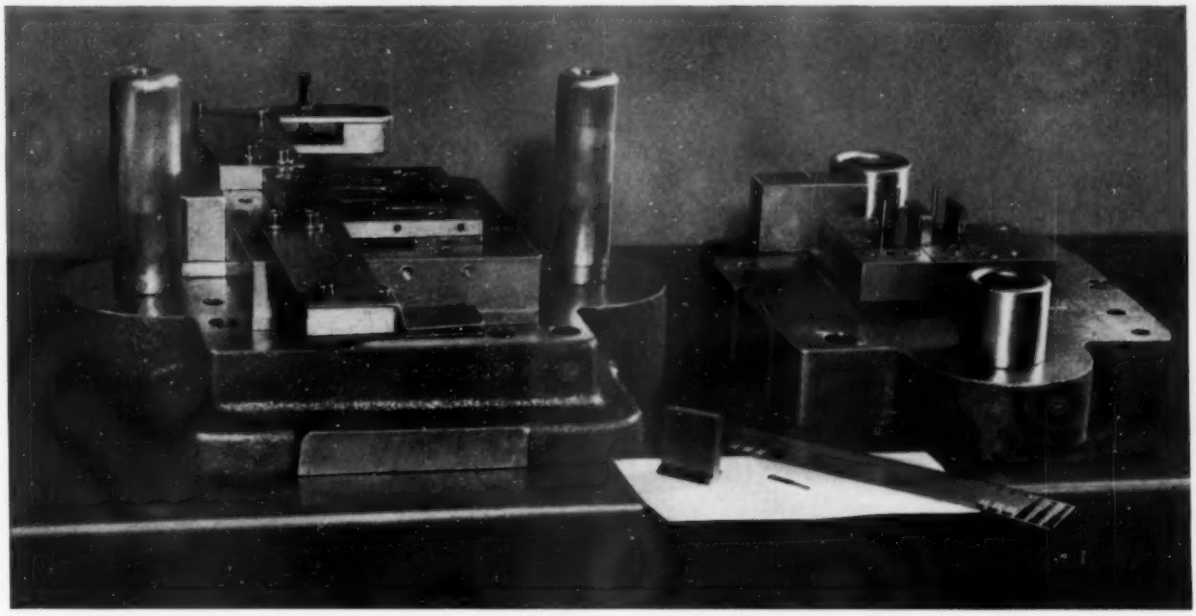
Size	Threads per inch					
	Coarse (UNC or NC)	Fine (UNF or NF)	Extra Fine (UNEF or NEF)	8-Thread series (N)	12-Thread series (UN or N)	16-Thread series (UN or N)
0	.....	80	.....	.....	.....	.....
1	64	72	.....	.....	.....	.....
2	56	64	.....	.....	.....	.....
3	48	56	.....	.....	.....	.....
4	40	48	.....	.....	.....	.....
5	40	44	.....	.....	.....	.....
6	32	40	.....	.....	.....	.....
8	32	36	.....	.....	.....	.....
10	24	32	.....	.....	.....	.....
12	24	28	32	.....	.....	.....
¼	20	28	32	.....	.....	.....
5/16	18	24	32	.....	.....	.....
⅜	16	24	32	.....	.....	.....
7/16	14	20	28	.....	.....	.....
½	13	20	28	.....	12	.....
9/16	12	18	24	.....	12	.....
⅝	11	18	24	.....	12	.....
11/16	.....	.....	24	.....	12	.....
¾	10	16	20	.....	12	16
13/16	.....	.....	20	.....	12	16
⅞	9	14	20	.....	12	16
15/16	.....	.....	20	.....	12	16
1	.....	14	.....	.....	.....	.....
1	8	12	20	8	12	16
1 1/16	.....	.....	18	.....	12	16
1 1/8	7	12	18	8	12	16
1 3/16	.....	.....	18	.....	12	16
1 1/4	7	12	18	8	12	16
1 5/16	.....	.....	18	.....	12	16
1 3/8	6	12	18	8	12	16
1 7/16	.....	.....	18	.....	12	16
1 1/2	6	12	18	8	12	16
1 9/16	.....	.....	18	.....	.....	16
1 5/8	.....	.....	18	8	12	16
1 11/16	.....	.....	18	.....	.....	16
1 3/4	5	.....	16	8	12	16
1 13/16	.....	.....	.....	.....	.....	16
1 7/8	.....	.....	.....	8	12	16
1 15/16	.....	.....	.....	.....	.....	16
2	4½	.....	16	8	12	16

Note: This table shows the standard sizes to and including 2". Other standard sizes through 6" are shown in the U.S. Dept. of Commerce, National Bureau of Standards Handbook H28 (1957) Part 1.

Tool Steel Topics

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



Blanking Die Output Doubles When Bearcat Takes Over

At the Remington Rand Division of Sperry Rand Corp. they were getting up to 50,000 pieces from a set of dies that blanks and forms grooved pins from .025-in. steel strip. Our local tool steel distributor, Leed Steel Co., suggested a change to our Bearcat tool steel. Result? The output increased to about 100,000 before the die needed reworking.

Bearcat has exceptional resistance to wear and shock. Because of its air-hardening characteristic, Bearcat minimizes quenching hazards and distortion in heat-treatment.

WIDE RANGE OF APPLICATIONS

In addition to blanking and forming jobs, Bearcat can be used economically in such varied applications as shear blades, punches, rivet sets, hot headers, die-casting die inserts, and master hobs. In fact, wherever the job calls for a grade having unusual toughness, Bearcat is the answer.

Your Bethlehem tool steel distributor carries Bearcat in stock in a wide size range. He's ready to serve you at a moment's notice. Give him a call today.

←Memo to Die-Casters:

USE CROMO-HIGH V (H-13)

You can't go wrong when you choose Bethlehem Cromo-High V (AISI-SAE H-13) for die-casting. This 5 pct chromemoly grade, with 1 pct vanadium, has good resistance to wash and erosion, plus plenty of toughness. It's uniformly annealed, for easy machinability. It also has good center density and grain refinement, and is free from porosity.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

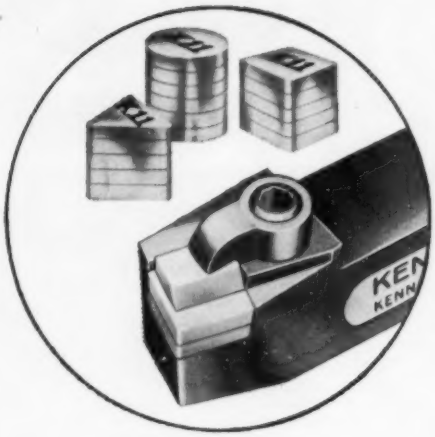
Periodic Regrinding Improves Tool Life

The service life of many types of tools can be improved if the tools are periodically reground at intervals before they have deteriorated to a degree which impairs their function.

This practice is particularly useful when applied to tools which repeatedly fail in service by fatigue, chipping, spalling, or cracking through heat checks. The objective of preventative grinding is the removal of service-damaged metal before the damage progresses to a depth which would not be removed in normal redressing operations. It is an application of the old proverb, "A stitch in time saves nine," and is just as appropriate when applied to tools as to a small rip in a piece of wearing apparel.

The point at which regrinding should be done during the service of a given tool must be developed by experimental work. It is most practical if it can be made to coincide with a normal shutdown of an operation for other reasons.

KENNAMETAL* K11



A specialty grade in 1955 ...a production grade today

Created four years ago to provide the greatest possible resistance to abrasion, K11 soon demonstrated exceptional performance in finishing and light roughing of cast iron, alloyed cast iron, brass, bronze, and light alloys. Today, under certain conditions, K11 is also being used for light cuts on steel, as well as for machining unfired ceramic materials, resin materials, and plastics.

Having a hardness of 93.0 Rockwell A, K11 has been found particularly suitable for such precision operations as boring brake drums, machining cam shafts, finishing pistons and sleeves. It is also recommended for die inserts for compacting ceramics, abrasive wheels and other applications involving severe abrasion.

Here are a few examples of K11 "success" stories from many varied applications:

A. Turning SAE 1213 steel rotors . . . At 298 sfm (2550 rpm), K11 increased pieces per insert from 750-1000 to 7500-9000.

B. Machining cast iron . . . K11 averaged 11.7 pieces with .008″ wearland. Closest competitive carbide could produce only 9.7 pieces with .016″ wearland. Considering rate of wear, K11 performance represents a 3 to 1 improvement.

C. Machining Fiberglass missile parts . . . on tests K11 provided 15% greater tool life than the best of three other makes of carbides. K11 has been used continuously on this job for over a year.

D. Finish facing modular iron flywheels . . . K11 increased output from 30 to an average of 100 pieces per cutting edge.

E. Boring welded bracket of 1020 steel . . . K11 is producing 70% more pieces per cutting edge at 100 sfm, .020″ depth and .002″ feed.

K11 is now available from stock ...at stocked grade prices

Due to outstanding performance on these and many other difficult jobs, demand for K11 has increased rapidly. To meet this growing popularity, K11 inserts are now available from stocks at Kennametal plants in Latrobe and Detroit. Triangular, square and round inserts with negative rake; also square and triangular inserts with positive rake are being stocked and are available at stocked grade prices, Group II.

For more information about this hard Kennametal grade, see your Kennametal Representative or write KENNAMETAL INC., Latrobe, Pa.

*Trademark

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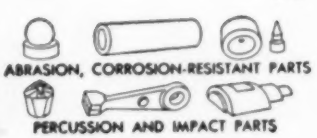
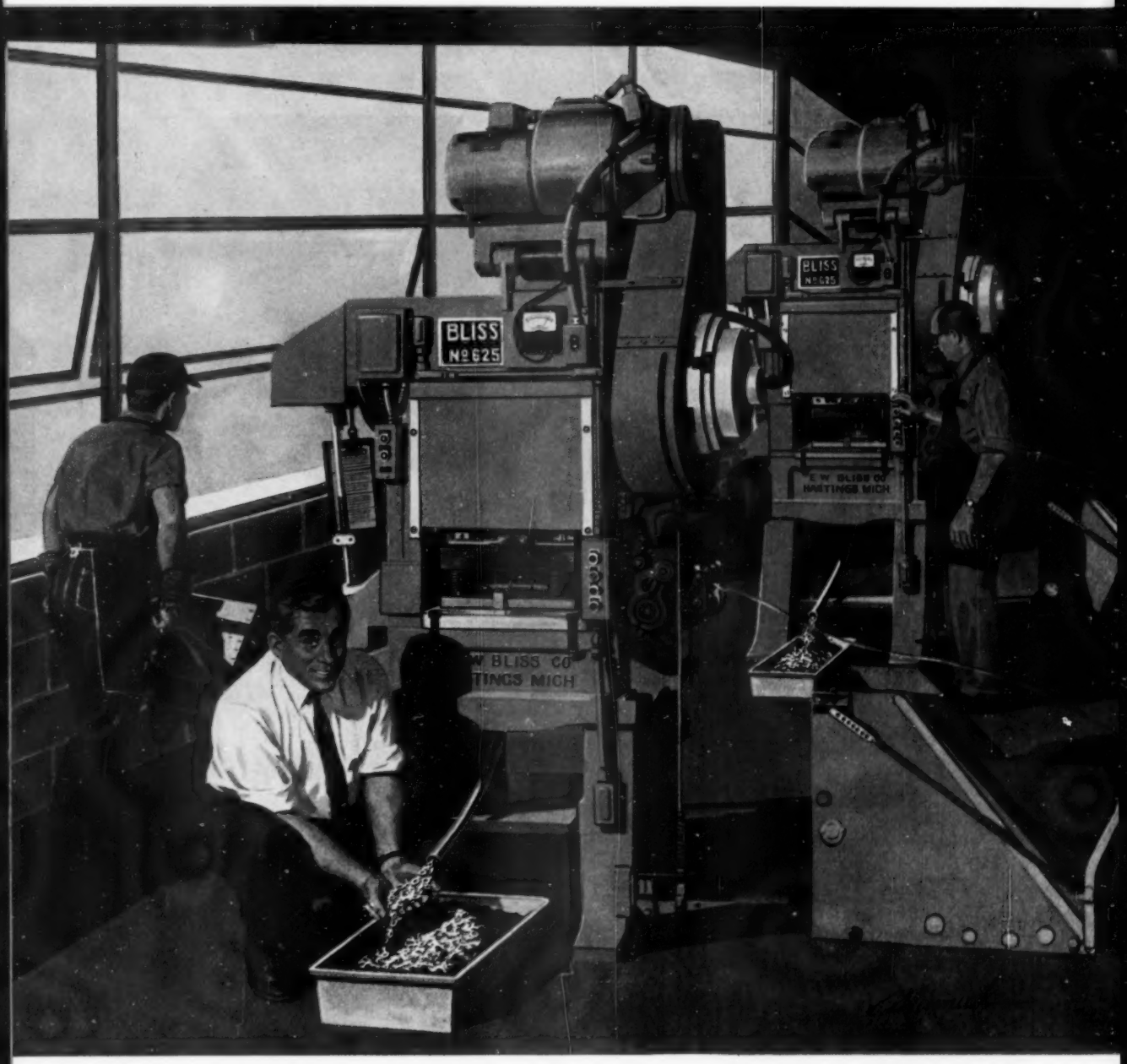
INDUSTRY AND **KENNAMETAL** ...Partners in Progress





"I get 1200 parts a minute from each of these presses...

...all day long!" And production like that continues day in, day out. For Bliss High Production presses are especially designed for continuous high speed operation. Counterbalanced shaft, massive tie rod frame... square gibbing... features like these add up to *enduring* speed. For ease of operation there's ample room in front and back for die setting and space *under* the press for tote boxes or stacking chutes. Naturally, if you use large quantities of stampings this is the press that makes them. You will, however, be surprised to learn, that H-P presses can be set up so quickly and efficiently that more and more firms are using them for short run work.

BLISS
SINCE 1857

E. W. BLISS COMPANY · Canton, Ohio

BLISS is more than a name... it's a guarantee

PRESSES • ROLLING MILLS • ROLLS • DIE SETS • CAN MACHINERY • CONTRACT MFG.

Lionel gets finer finishes with Gulfcut . . . prevents metal

GULF MAKES THINGS

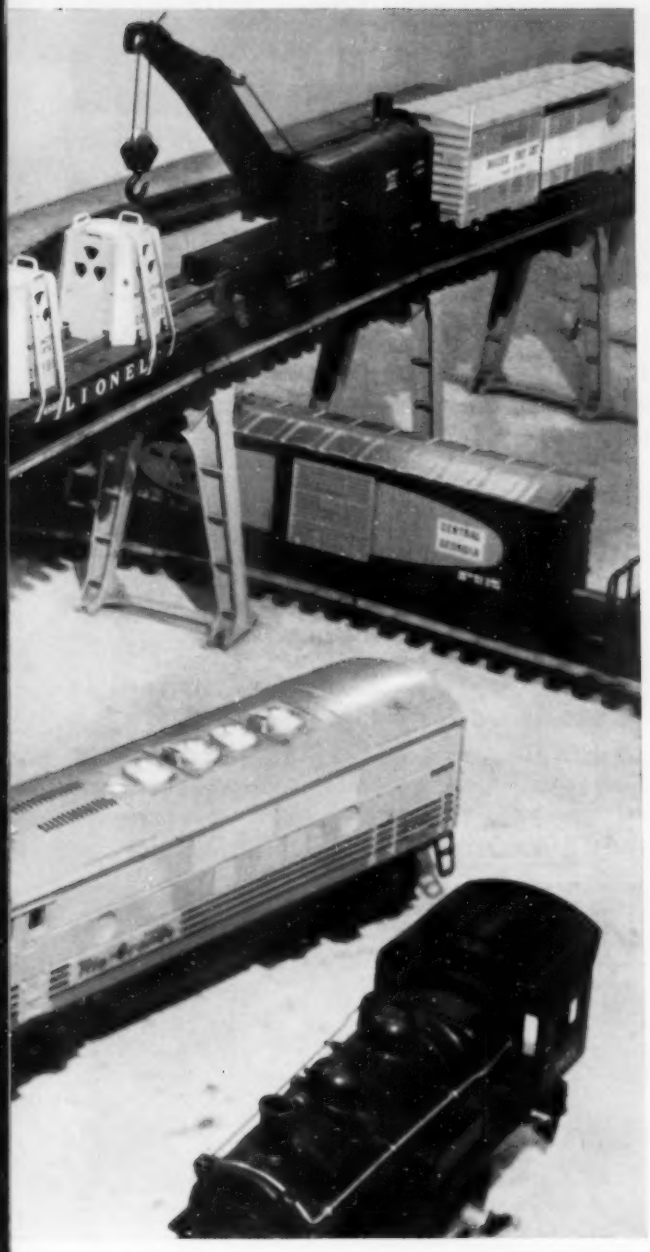
Top calibre machining, use of the right cutting oils, and a rigid inspection system are three big reasons for the high quality of the famous toy trains made by Lionel Corporation, Irvington, New Jersey.

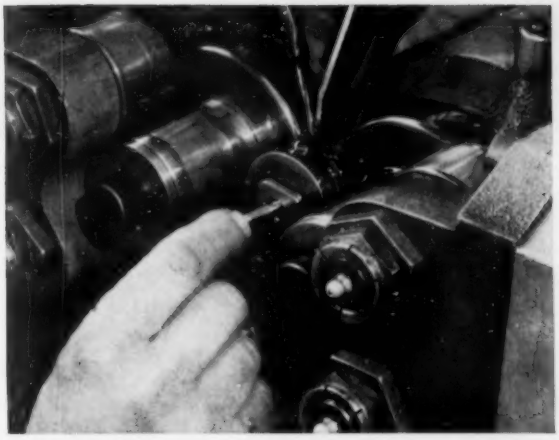
Lionel engineers have found that Gulfcut 31C is the right oil for a great variety of their cutting operations. One in particular stands out—rolling a triple thread on a worm gear shaft for toy locomotives.

Lionel used to cut these gear shafts with a hobber, but decided on the rolling method to increase production and improve finish. For the coolant-lubricant they chose Gulfcut 31C, an oil that meets all the tough requirements of thread-rolling.

Gulfcut 31C has such outstanding anti-weld properties that metal seizure is never a problem in this operation.

Lionel is now producing these gear shafts 5 times faster than with the cutting method. Gulfcut 31C helps them get finer finishes on these shafts and on other machined products, including such diversified items as fishing reels and fuse casings for the Air Force.





Reed Thread Roller at Lionel plant, where Gulfcut 31C is the coolant-lubricant in the machining of worm gear shafts. Triple thread is rolled on a ⅛" shaft of SAE 1010 Steel.

Sizing up the finished product are Jacques Schindler, right, Gulf Sales Representative, and Thomas Pagano, Chief Engineer, Lionel Corporation.

Wonderful way to run a railroad. Lionel insures top performance in its toy locomotives with high quality machined parts. Gets finer finishes on gear shafts by machining with Gulfcut.

seizing in thread rolling operations...

RUN BETTER!

How about your machining operations? In the complete Gulfcut line, there's a cutting oil to meet your every need. For information just call a Gulf Sales Engineer at your nearest Gulf office. Or mail coupon for illustrated bulletins.

GULF OIL CORPORATION
Dept. DM, Gulf Building
Pittsburgh 30, Pa.

GULF

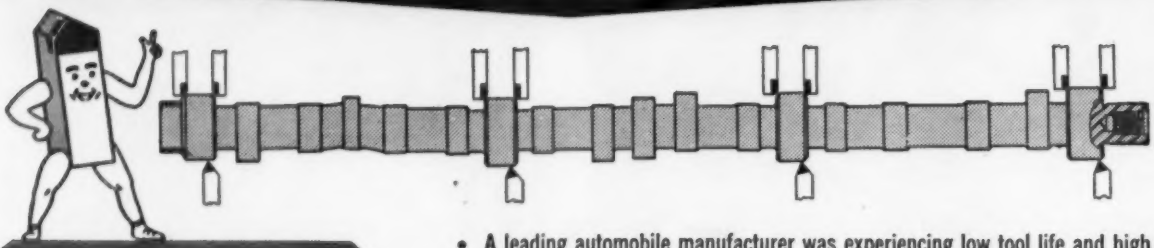
GULF OIL CORPORATION
Dept. DM, Gulf Building, Pittsburgh 30, Pa.

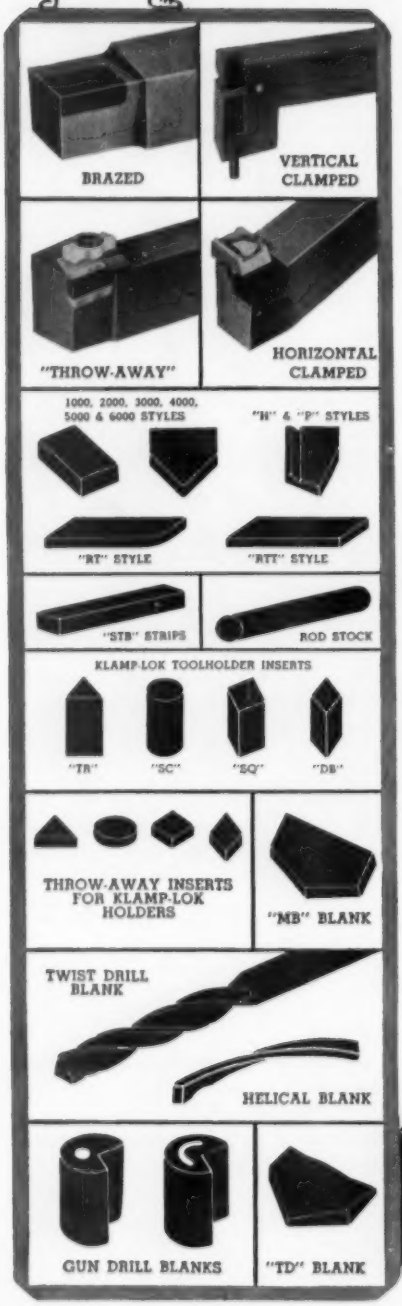
Send me more information on: ☐ Gulfcut "Regular" Cutting Oils. ☐ Gulfcut Heavy Duty Soluble Oil.

Name_____
Title_____
Company_____
Address_____
City_____ Zone_____ State_____

TX-5237

1020 CAMSHAFTS MACHINED WITH Talide® C-91!





• A leading automobile manufacturer was experiencing low tool life and high costs machining camshafts made of tough, highly abrasive ArmsSteel. Talide tool engineers installed Grade C-91 with the following superior results:

GRADE C-91 CASE HISTORY

Part..... Automobile camshaft

Material....ArmsSteel 1.8165 dia. x 23-½" long, 32 Rc hardness

Operation.. Rough turning 4 bearing surfaces

Machine....Sundstrand Model #8 automatic

Tools.....4 Talide TB-123 ⅜" I.C. x 1-½" long triangular inserts, Grade C-91, mounted in Klamp-Lok toolholders

Depth of Cut..1/16" to 3/32"

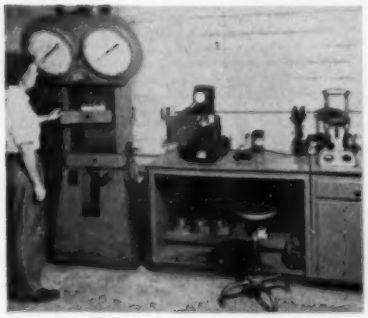
Feed.....012

Speed.....130 (S.F.M.) 274 (R.P.M.)

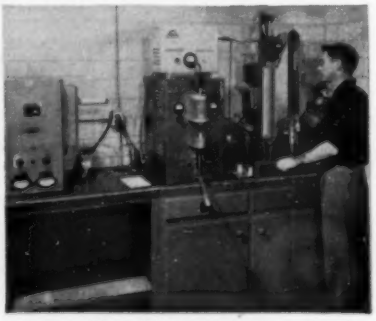
Coolant.....Soluble Oil

Results....Talide Grade C-91 machined 1020 camshafts per grind compared to 550 for 2nd best competitive grade and 275 for 3rd best. Special attention to the grind and chip breaker detail resulted in Grade C-91 outperforming all other grades used previously.

QUALITY CONTROL GUARANTEES TOP TOOL PERFORMANCE . . .



Determining rupture strength of test bar. Hardness is determined on Rockwell machine, center.



Leco and Burrell instruments are employed in the analysis of metal oxides.

• A constant research program at Metal Carbides pays off in improved Talide grades having extra high hardness, strength, rupture resistance and crater resistance properties. Processed in latest type vacuum electric furnaces—all Talide grades are uniform and consistent in quality.

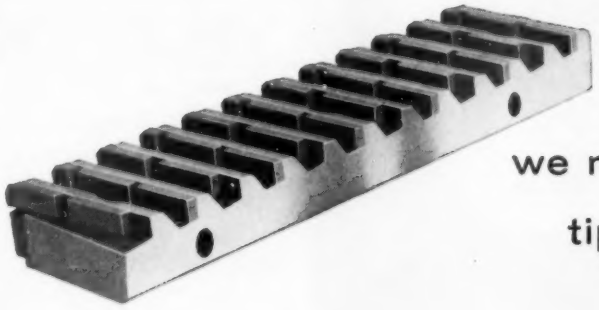
Write for Catalog 56-G

METAL CARBIDES CORPORATION
TALIDE®
YOUNGSTOWN 12, OHIO

Metal Carbides Corporation Youngstown 12, Ohio

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

Everybody knows that
National Tool Company
makes special hobs—



But did you know
we make special carbide
tipped surface broaches...

and more special cutting tools of all kinds
than any other tool manufacturer?

For more than half a century National Tool Company has supplied high quality precision cutting tools to the metal working industry. When your job requires special cutting tools call your National Tool representative. His assistance is yours for the asking whether you're interested in one special tool or a complete tooling program.

National Tools Cleveland

National
TOOL CO.
Cleveland 2, Ohio

Representatives in major industrial centers

New FREE Catalog

To National Tool Co., 11200 Madison Ave., Cleveland, Ohio

Please send NEW 92 page catalog showing National Tool Company's complete line of *special* tools for the metal-working industry.

Name_____

Position_____

Company_____

Address_____

City_____ Zone_____ State_____

The Federal

No adjustment diddling. Set this gage quicker than you can set your watch. Once set, it *stays* set! *It won't drift.*

No need to keep a stockpile of dials. This 7½" accurately calibrated, *all-usable* scale will answer every normal gaging need. Operator cannot change magnification or monkey with your tolerance specifications. Dimensionair is fool-proof. To meet the occasional finer or coarser measuring requirements, other magnifications are available.

Finger tip attachment. Longer approach range lets you see where you are going. Greater plug clearance for faster, easier gaging — less wear: No scoring or jamming, greater exploration of out-of-round, taper, irregularities. No centralizing error. Deep-set air jets give longest useful life; large and self-cleaning, jets clean work while they gage.

NOTE:
Accurate setting is guaranteed with one master. However, the Dimensionair can be used equally as well *with two* if your standards so specify.

DIMENSIONAIR

This air gage will measure

- More Accurately
- More Dependably
- Faster (Greater Plug Clearance)
- With Less Maintenance Cost
- With Less Dependence On Skilled Help than any other air gage you can buy.

This is a statement we are ready to prove. Don't take our word for it. TRY the Dimensionair on a "no-strings-attached" trial basis.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

mail coupon today

Federal Products Corporation
9193 Eddy Street • Providence 1, R. I.

OK Prove it! Let us try a DIMENSIONAIR

Name .....

Company .....

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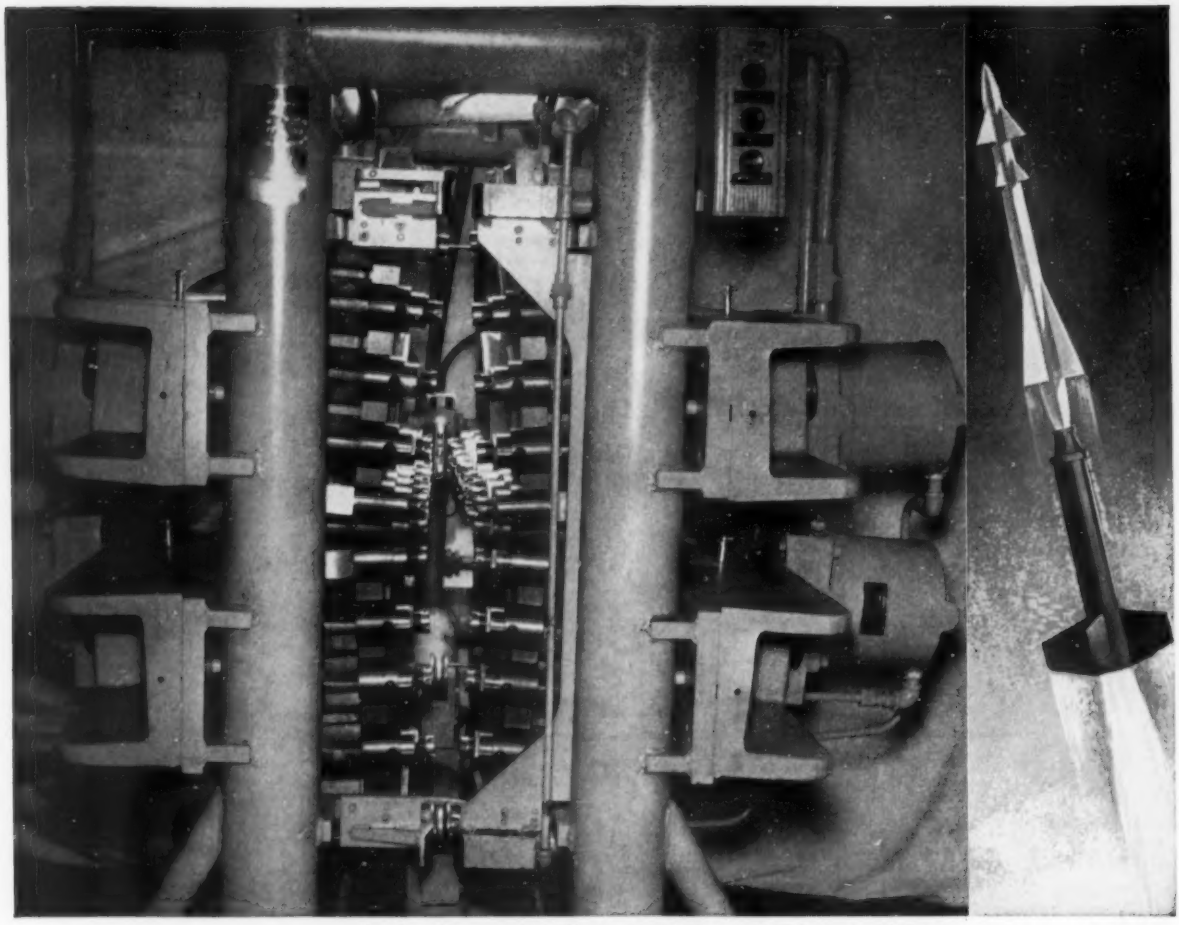

Gardner-Denver air drills in special fixture drill holes for Nike fins.

Single air tool setup drills and countersinks 108 holes in 2 minutes

A PATTERN OF MULTIPLYING PRODUCTIVITY

A 100-year philosophy of growth—*there's no substitute for men*—has been confirmed again and again by Gardner-Denver air tool specialists. Their assistance in planning multiple screw driving, nut setting, and drilling setups has helped men in industry everywhere multiply productivity and cut costs.

One phase of fin fabrication for Nike missiles calls for drilling and countersinking 108 holes to exacting depths. Gardner-Denver air drills in this special fixture do the job in two minutes—automatically—at the touch of a button.

Multiple drilling problems, complex or simple, are easily solved with flexible Gardner-Denver air tools. Number of holes, different hole sizes, angles or drilling depths present no problem. A specially designed fixture with proper components from the Gardner-Denver air tool line can be engineered to fill every practical need.

Gardner-Denver can design and build you a complete special machine or we can work with your engineers to develop a fixture for your needs . . . help you select air tool components to meet exacting requirements. Get in touch with your Gardner-Denver air tool specialist soon.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

YOU DON'T HAVE TO BABY CARMET CARBIDE TOOLS

—on short or long runs!

A full range of Carmet Carbide cutting tools are available to answer every cutting need . . . and allow you to cut with profit. The Carmet Carbide Tips are carefully brazed to alloy steel shanks, strong, tough and beefed up in design to support the carbide.

Full guidance in selecting the proper grade, assistance in selecting the proper tool, is available locally from your Carmet Distributor. He stocks a full line, is there to serve you. Call on him or the Carmet Service Engineers whenever they can help. Carmet Division, Allegheny Ludlum Steel Corporation, Detroit 20, Michigan.

USE THIS CARMET GRADE SELECTION CHART

. . . then machine at optimum feeds and speeds

Carmet Grade	Application	Industry Designation
CA-3	For heavy machining of cast iron and nonferrous material. 300 series stainless.	C-1
CA-4	Machining cast iron and nonferrous material. 300 series stainless.	C-2
CA-604	High Velocity finishing.	C-8
CA-605	Precision boring steel. Light, fast cuts.	C-8
CA-606	Light, fast machining on steel, stainless and high temp. alloys.	C-7
CA-608	Light to medium-heavy machining on steel.	C-7
CA-610	General machining on steel. Heavy roughing cuts.	C-6

WSW 7332 A

FREE NEW CARMET CATALOG

This 32-page first edition contains prices and complete specifications on Carmet's full line of cemented carbide tipped tools, Indexable Inserts, blanks and holders. Speed and feed charts, grade comparisons and ordering information included.

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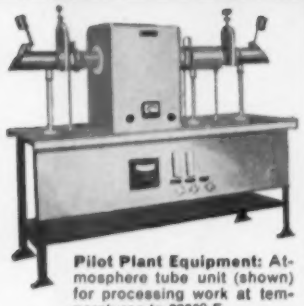
CARMET

CEMENTED CARBIDE DIVISION OF
ALLEGHENY LUDLUM STEEL CORPORATION

Wherever industry needs heat...

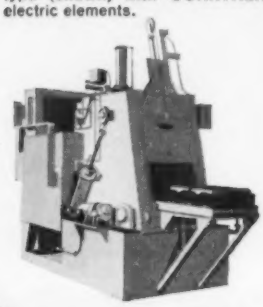
You'll find LINDBERG equipment just right for the specific job

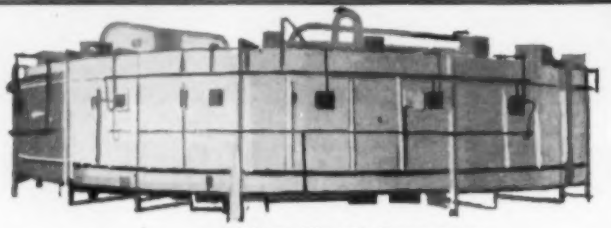


Pilot Plant Equipment: Atmosphere tube unit (shown) for processing work at temperatures to 2200° F.

Roller Hearth Furnaces: Continuous electric type (shown) with temperature range 1300° to 2100° F.

Automatic Carbonitriding Furnaces: Automated integral quench type (shown) with CORRTHERM electric elements.

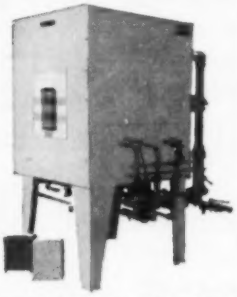




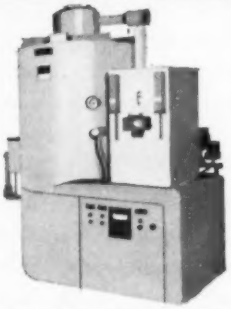
Rotary Hearth Furnaces: Doughnut type field-installed gas-fired furnace (shown) with capacity of 13,000 lbs. per hour.

Vertical Type Furnaces: Carburizing and hardening furnace (shown) with CORRTHERM electrical heating elements.

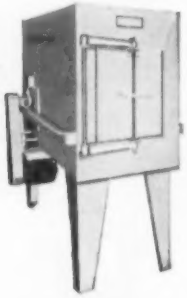
HF Induction Heating Units: Available in 5, 10, 25 and 50 KW units.



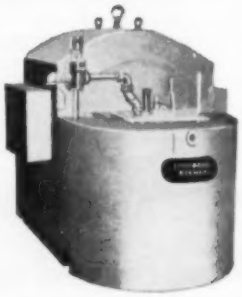
Ceramic Kilns: Gas-fired periodic kiln (shown) with temperature range to 3250° F.



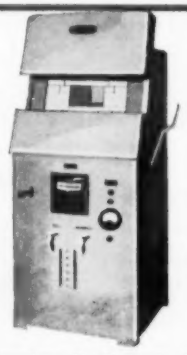
Atmosphere Generators: Hyen generator (shown) for endothermic atmospheres. Generators for all required atmospheres.



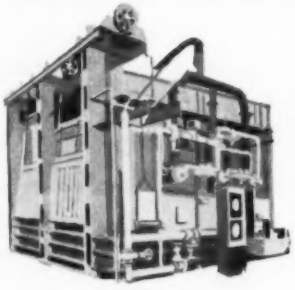
Tempering Furnaces: Box type Cyclone (shown). Temperature range to 1250° F.



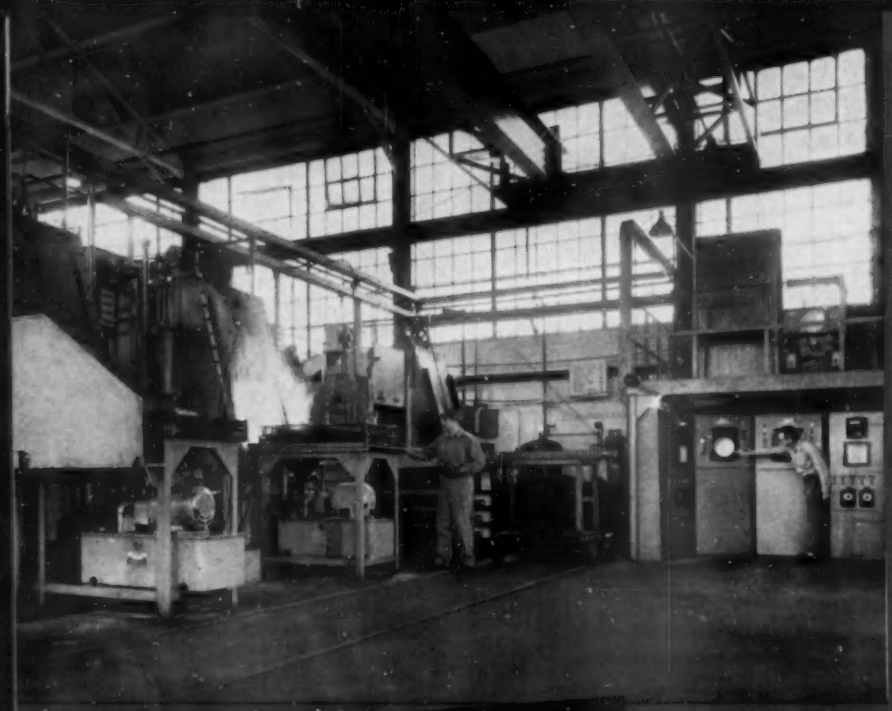
Melting and Holding Furnaces: Electric resistance furnace (shown) with capacities of 750 lbs. to 1500 lbs.



Laboratory Equipment: One-unit box furnace (shown), muffle or for non-oxidizing atmosphere with temperature range to 3000° F.

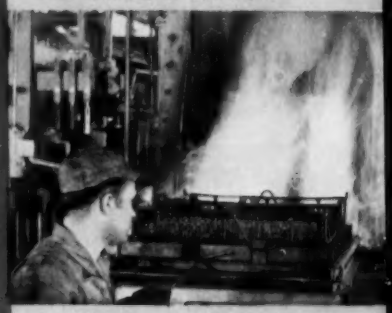


Aluminum Reverberatory Furnaces: Twin-chamber melting and holding furnace (shown) with 45,000 lbs. capacity.



Lindberg-Designed

Charles Hewitt, President of Dayton, says, "The Lindberg installation has kept our production at a consistently high quality level."



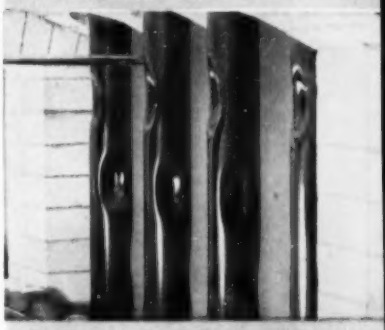
Work loads are positioned manually, but entire furnace operation is fully automatic.

Unique Installation Cuts Heat Treating Costs and Improves Quality at Dayton

Here is a remarkable set-up for general heat treating now in operation at Dayton Forging & Heat Treating Company, Dayton, Ohio. Two integral quench atmosphere furnaces, largest of this type ever built by Lindberg, and one atmosphere tempering furnace in a "three-in-a-row" arrangement that simplifies transfer operation. Combined with Lindberg Carbotrol and Hyen generator, the entire furnace operation is completely automatic, including atmosphere control and recording. Planned by Dayton and Lindberg engineers, the installation runs around the clock, six days a week, reducing costs and producing cleaner end products, brighter job finish, freedom from "decarb" and a consistently higher quality of work.

This is another example of how Lindberg equipment and Lindberg planning can help you find the most effective answer to any problem of applying heat to industry. We cover the field, heat treating, melting and holding, tempering, brazing, enameling furnaces, ceramic kilns, high frequency units, and are in the ideal position to recommend just the type of equipment most suitable for your needs. This can be factory built or field-installed in your own plant, fuel-fired or electric, whatever is best suited to your production processes. Consult your local Lindberg Field Representative (see the classified phone book) or get in touch with us direct. Lindberg Engineering Company, 2447 West Hubbard Street, Chicago 12, Illinois. Los Angeles Plant: 11937 S. Regentview Avenue, at Downey, California.

Lindberg Carbotrol unit automatically controls and records "dew point" and heating cycles of endothermic atmosphere.

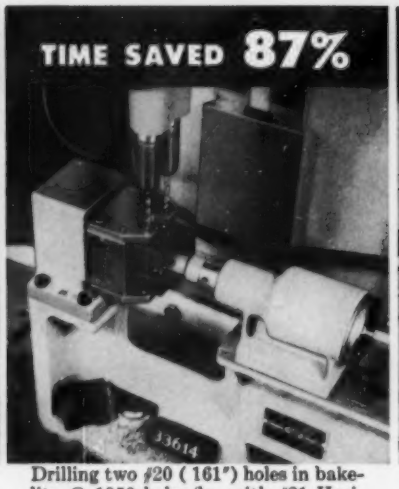


Lindberg's "dimple" vertical radiant tubes give remarkably trouble-free service and function at all times at full efficiency.

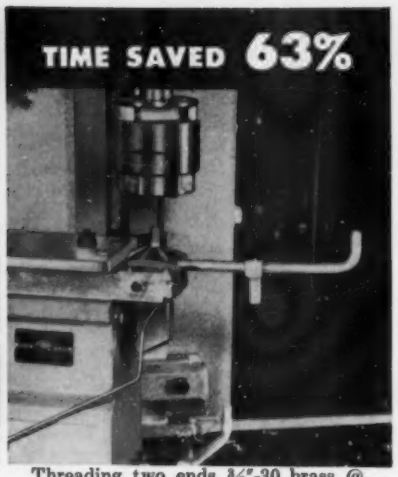
SEE LINDBERG IN BOOTH NO. 660 at the WESTERN METAL CONGRESS

LINDBERG heat for industry

Tapping three 5/16"-18 holes in steel @ 1800 holes/hr. with #X-11 Piece Part Fixture.



Drilling two #20 (.161") holes in bakelite @ 1950 holes/hr. with #21 Horizontal Clamping Fixture.



Threading two ends 3/8"-30 brass @ 1800 ends/hr. with #612 Air Vise.

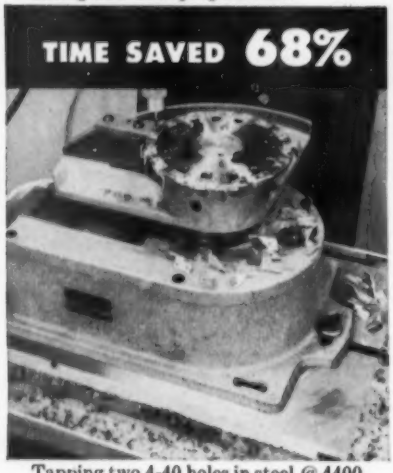
Drilling eight 3/16" holes in brass @ 1920 holes/hr. with #16 Vertical Indexing and Clamping Fixture.

can you take advantage of these savings

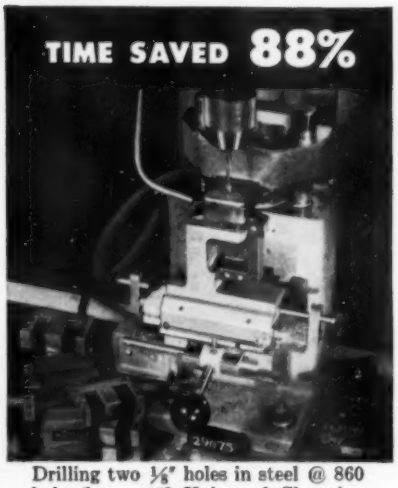
The average Snow machine pays for itself *completely* in 300 to 600 hours. That's only 9 to 17 weeks of 35 hours/week. A Snow machine can be idle 85% of the time and still pay for itself in one year.

Such savings are possible because Snow machines give two to four times the hourly production of non-automatic machines. 28 standard air-operated fixtures permit minimum tooling for each job. On your next job, let us show you what the Snow method can do. Send us your samples and prints.

Drilling 1/16" hole through brass @ 2600 holes/hr. with #15 Vertical Indexing Fixture.



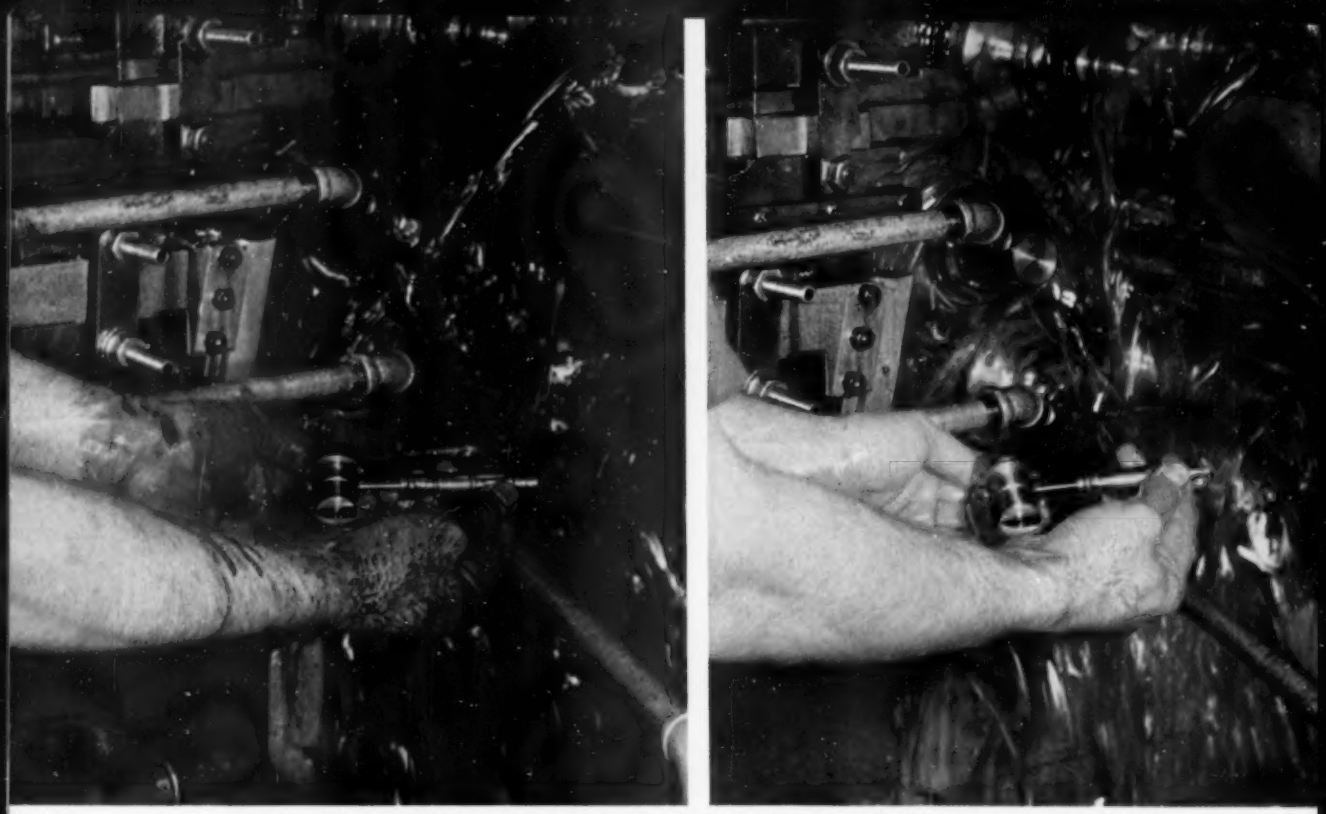
Tapping two 4-40 holes in steel @ 4400 holes/hr. with #18 Horizontal Indexing Fixture.



Drilling two 1/8" holes in steel @ 860 holes/hr. on #9 Universal Clamping Fixture.

Snow Manufacturing Company
Dept. T, 435 Eastern Avenue
Bellwood, Illinois (suburb of Chicago)

SNOW *master fixtures save dollars and days in tooling costs.*



Black cutting oil (left) makes close control difficult. Operators dislike dirty operating conditions it creates. Close control is easier and workers are happier with transparent Sunicut cutting oil (right).

WHY USE A BLACK CUTTING OIL WHEN YOU DON'T NEED IT?

Sunicut oils give you better visibility without sacrificing machining efficiency.

When trying to maintain close control over machines producing precision parts, operators can be handicapped by "black-oil blindness". It is hard to see the tools, the workpiece, and the finishes. Checking close tolerances is difficult when the graduations on micrometers and gauges are obscured.

Worse still, as the operator sees it, are the dirty working conditions caused by dark oils. His clothes get saturated with hard-to-remove stains, and his hands are black from one end of the shift to the other.

Transparent Sunicut oils help keep your operators happy and will make close control easier ...and transparent Sunicut oils will do the job with no sacrifice in machining speed or finishes.

To get the full story on Sunicut oils, see your local Sun representative, or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-41.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILADELPHIA 3, PA.

IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

For any machining or grinding operation...

THERE'S A SUN OIL THAT'LL GIVE YOU HIGH EFFICIENCY AND LOW OVER-ALL COST

No two machine shops have exactly the same problems when it comes to selecting cutting oils...even when they're running the same job. And, until somebody comes up with the truly universal cutting oil, you can't afford to disregard the importance of oil selection. Here's how Sun can help you.

First, Sun makes a complete line of emulsifying and straight cutting and grinding oils. Second, your Sun representative, backed up by field engineers, has the necessary practical experience to recommend the oil that will give you both high machining efficiency and low over-all costs.

For the full story about Sun's cutting oils, see your Sun representative...or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-42.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILADELPHIA 3, PA.

IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

now a

ROTATING BURNER

for CINCINNATI flamatic

Flame Heating Machines!

- **flame head spins within the area of the part to be heated**
- **simplifies spin hardening of parts difficult to rotate—eliminates expensive fixtures**
- **cuts hardening costs all around**

This newest development of the Meta-Dynamics Division Heat Treating Laboratories brings lower costs to precision selective flame heating of a wide range of parts, because the flame head rotates—*not* the work. The gas-tight rotating joint of the burner has undergone more than 1000 hours of test, with no sign of leakage.

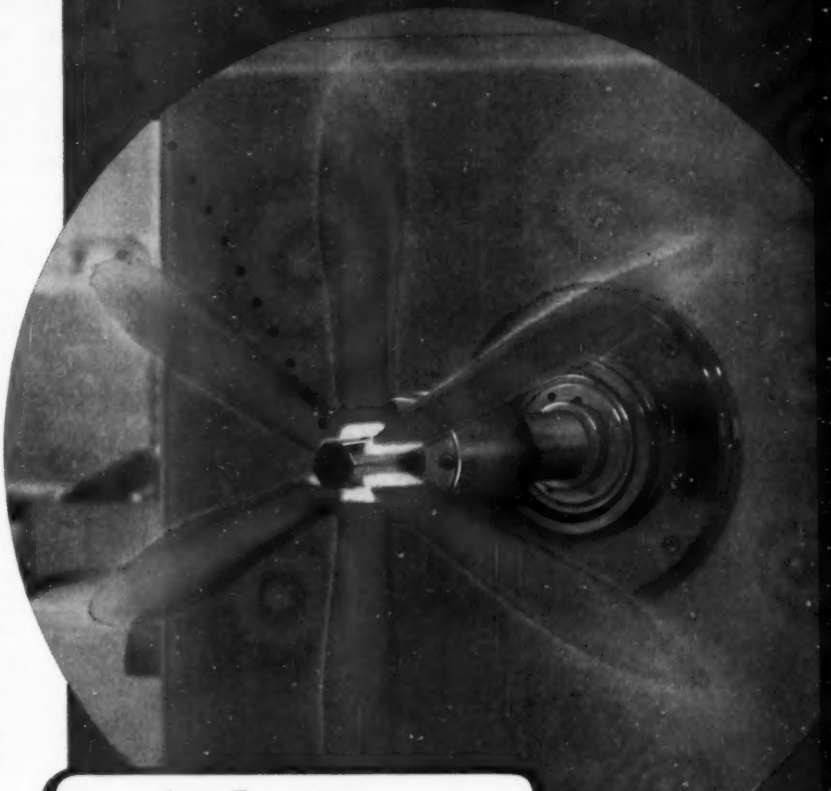
The rotating burner and workholding fixture mount on the flat bed of the basic machine, which contains a quench tank and part removal conveyor. Automatic timing, temperature and quenching control are provided. A separate control cabinet provides accurate control of gas, oxygen, air and water. Other "building blocks" (flame heads and fixtures) are available for such work as brazing and spot, spin, progressive and combination spin-progressive hardening.

For your heat processing work, look to the Cincinnati Flamatic for lowest cost flame heating . . . and the Cincinnati Inductron (built in 15, 30, 50 KW capacities) for lowest cost induction heating. Call in a Meta-Dynamics Division field engineer for full details.

TYPICAL PARTS SUCCESSFULLY HARDENED BY THE FLAMATIC ROTATING BURNER

INTERNAL THREAD of steering knuckle control arm, a pearlitic malleable casting, hardened to Rc 58-60. I.D. is 1¾"; thread length, 1⅛"; overall part length, 22½".

INTERNAL TEETH of SAE 1052 Ring Gear, hardened to Rc 58-60. Gear I.D. is 5¼"; tooth face, ⅝".



inductron
flamatic
hardening machines

META-DYNAMICS DIVISION
Machines for Metal Forming and Heat Treating

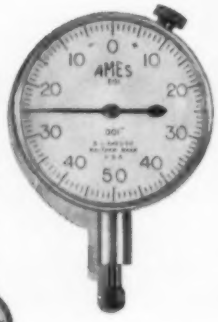
THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio, U.S.A.

CINCINNATI

PORTA-CHECK®
A transistorized portable comparator for fast accurate measurement in both "tenths" and "thousandths" scales.

MODEL AG AIR GAUGE
For checking diameters, dimensions, roundness, etc.

200 SERIES MICROMETER DIAL INDICATOR
One of four sizes. Made to AGD specifications.



NO. 2 DIAL COMPARATOR
For desk, bench or at-the-machine inspection of small parts.

AMES

Masters of Measurement...

For more than half a century, Ames measuring instruments have been regarded as the finest made. Today the constantly growing line of Ames indicators, gauges, micrometers and comparators includes such amazingly accurate instruments as the new Ames "PORTA-CHECK", an electronic comparator which gives accurate readings *in millionths of an inch*; and the new Model AG air gauge—also accurate to millionths of an inch. Wherever precision is *really* important . . . you'll find Ames "masters of measurement" on the job.

Representatives in Principal Cities

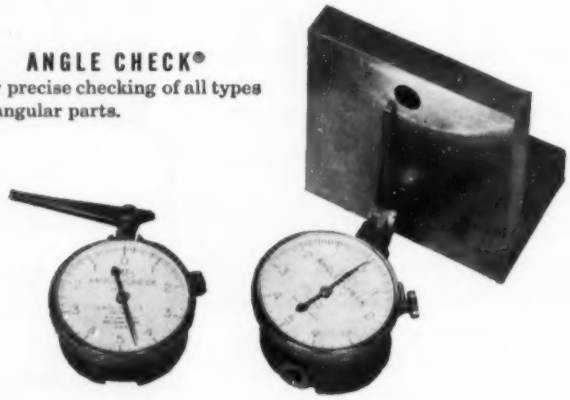
B.C. AMES CO.

30 Ames Street, Waltham 54, Mass.

Canadian Office — B. C. Ames Co., 45 Oriole Parkway, Toronto

MANUFACTURERS OF MICROMETER DIAL INDICATORS AND GAUGES

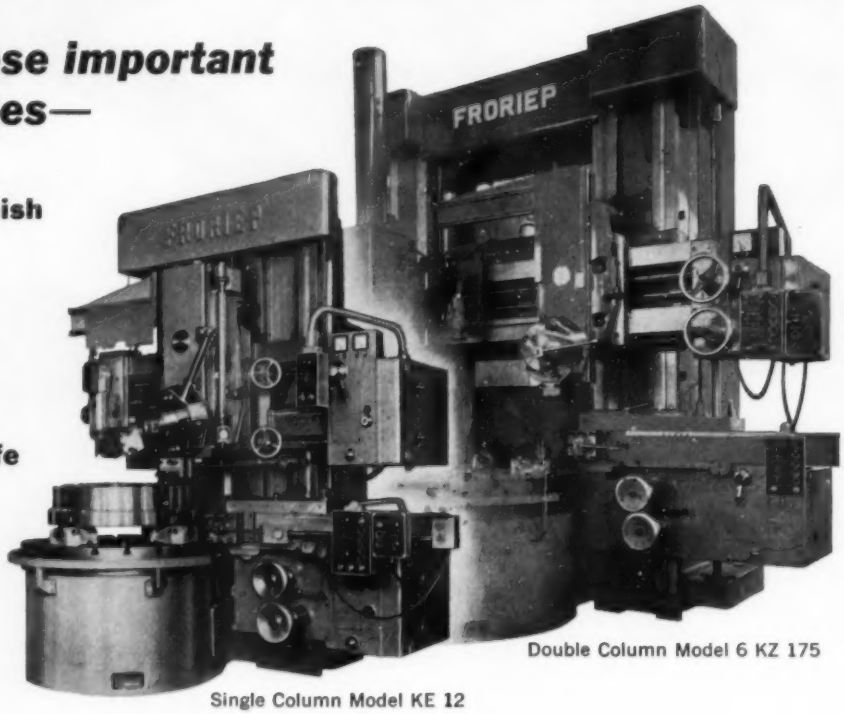
ANGLE CHECK®
For precise checking of all types of angular parts.



Constant Cutting Speed on FRORIEP Vertical Boring Mills

Provides these important advantages—

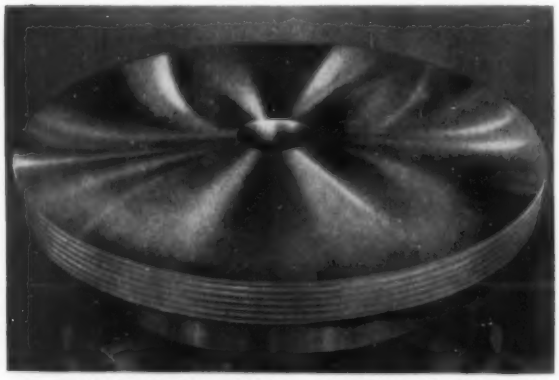
- **Equal surface finish over the entire facing range**
- **Greatly reduced cutting time**
- **Increased tool life**
- **Less down time**



Double Column Model 6 KZ 175

Single Column Model KE 12

Electro-magnetic clutches on a FRORIEP let you maintain constant cutting speed—regardless of decreasing diameter. By a remote electric control you can change quickly to any available speed—without stopping the table. You can adapt table revolutions instantly to the most economical cutting speed for any diameter. If desired, speed can also be set to change automatically, gradually increasing as cutter moves toward the center—and without interrupting the cut.



Uniform surface finish produced by a Froriep

Simple, conveniently placed push buttons and switches control feeds and rapid motion of turret, cross rail and side arm. Cross rail head and side arm operate independently with 12 pre-selected feeds each.

An electric tracer attachment will copy 90° in and 90° out, reproducing almost any shape but undercuts. Automatic tripping devices and combined taper-turning and threading attachment add even more versatility.

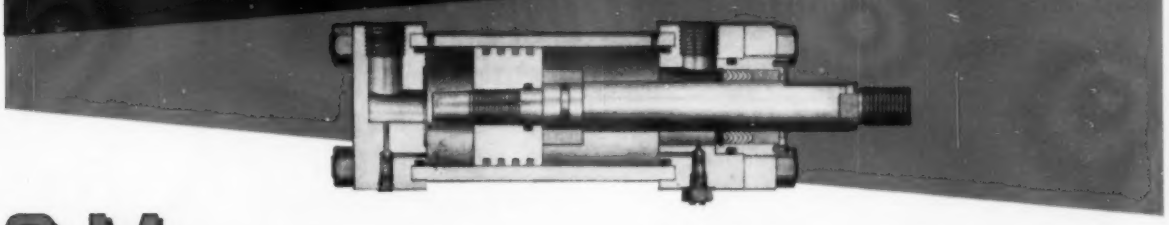
Capacities Available Single column models provide a choice of table diameters from 40″ to 63″; double column models from 69″ on up. Special designs also available on request.

Write For More Information

COSA — *nationwide sales and service of precision machine tools—from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

sealed right!



O-M Heavy-Duty Series TH Hydraulic (Oil) Cylinders

IF you are experiencing difficulty with leakage through the seals and packings of the cylinders you have been using, the O-M "TH" Series Heavy Duty Hydraulic cylinders may be the answer to your problem. Since their introduction in 1955 these cylinders have established an enviable reputation for efficient and trouble-free service.

The O-M Series TH Cylinders are Designed Right to Seal Right. Prior to the design of these cylinders, many tests were made and field experiences were surveyed to find the most efficient way to eliminate the old "leakage problem".

Homogeneous "O" rings, with their elastic characteristics, cannot be excelled as static seals when backed-up with plasticized leather non-extrusion rings and installed in a properly designed cavity.

Ring-type piston packings are excellent for long-life and trouble-free performance when a small amount of piston by-pass is permissible. When by-pass is not allowable, "Vee-type" packings similar to those used as standard in the rod gland provide optimum sealing. The "Vee-type" packing is self adjusting and provides multiple lip sealing with excellent pressure sensitivity and long life.

The homogeneous "lip-type" rod wiper or the metallic scraper (your choice) is located well forward so as to prevent dirt from accumulating and scoring the piston rod and damaging the bearing and packing.

O-M Series TH Cylinders are "Designed Right" and "Sealed Right". Available in 1½" to 8" bores with complete selection of mountings. Mail coupon TODAY for Bulletin No. 105 showing description drawings of cylinders mountings and capacity chart.

ORTMAN-MILLER MACHINE COMPANY
13 143rd Street, Hammond, Ind.

☐ Have representative call
☐ Send Bulletin 105

Name_____ Position_____

Company_____

Address_____

City_____ Zone____ State_____

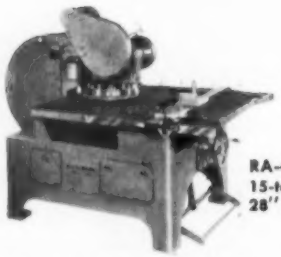
"CAN I GET 10 MORE TODAY?"

"Sure . . . with our WIEDEMANN"

From one of a kind to a thousand or more pieces . . . from a single hole to hundreds of openings of many sizes and shapes — rounds, rectangles, groups, louvers, notches, knockouts, etc. — you'll pierce your work faster and cheaper on a Wiedemann Turret Punch Press. The Wiedemann Method eliminates layout and setup. Savings of 60% to 90% are commonplace. That's why production men who know the difference invariably say "Run em on a Wiedemann," and why every job shop *must* have a Wiedemann section.

Job shop fabricators & manufacturers . . . discover the profitable difference a Wiedemann will make for you. Write today for Bulletin 301 — and send drawings of your work for free time study.

12 to 32 Punches and Dies Ready for Use



RA-41P Wiedemann
15-ton capacity
28" throat depth

Other models from 4 to 150 tons

WIEDEMANN
MACHINE COMPANY
TURRET PUNCH PRESSES

DEPT. TE-3 • GULPH ROAD • KING OF PRUSSIA, PA.

PARKER • MAJESTIC PM PRECISION MACHINES

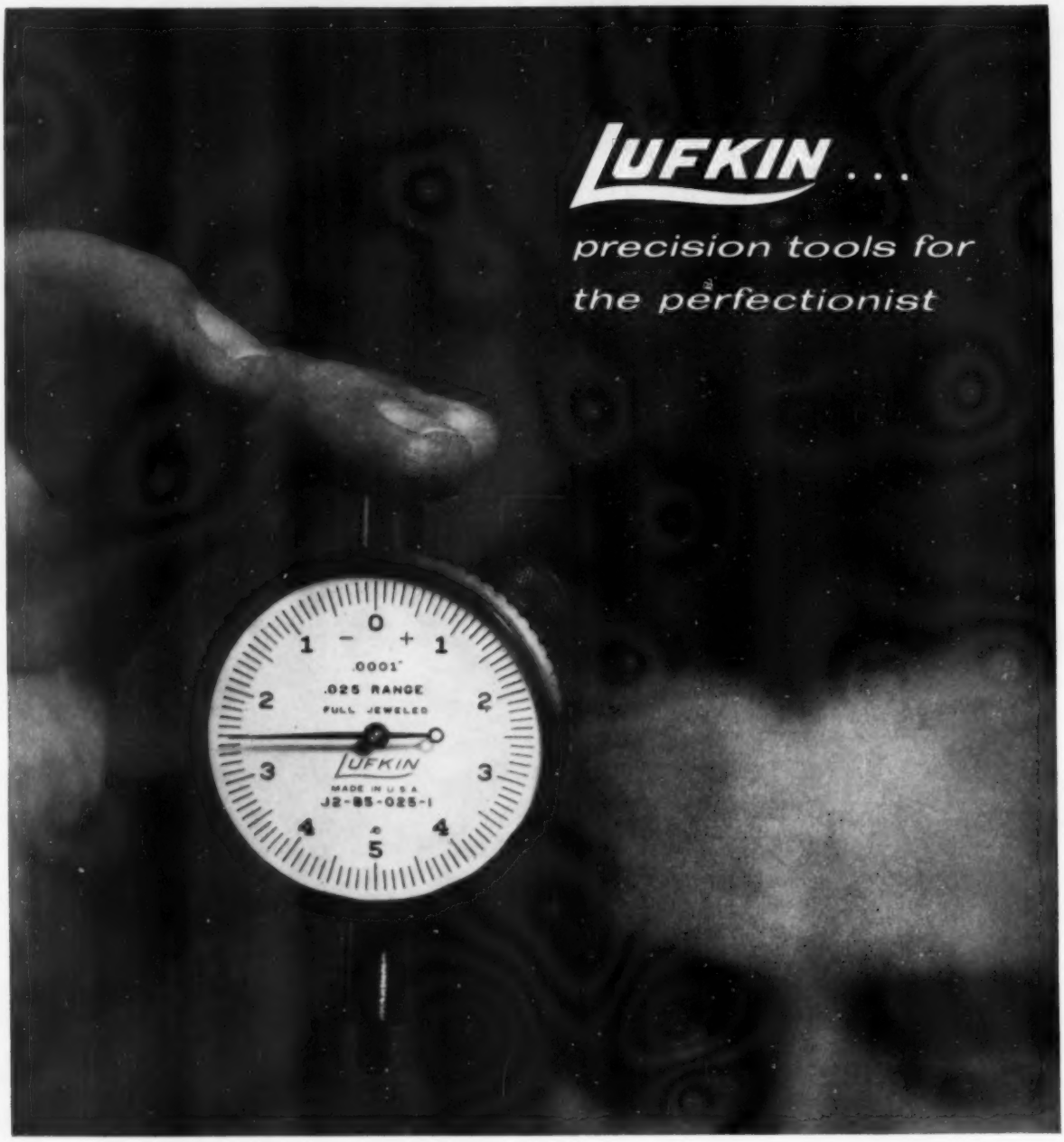
PARKER SPINDLES

FOR ANY MACHINE—FOR ALL APPLICATIONS

Following its development in 1915 and as a result of constant improvement through the years, the Parker Spindle has become one of the most widely used spindles in this country today on many makes of machines. The demand for speed and endurance in grinding, precision boring and milling which the Parker Spindle makes possible has made Parker-Majestic Incorporated the leading manufacturer of precision spindles.

PARKER-MAJESTIC, INC.

147 Joseph Campau • Detroit 7, Michigan



ALL NEW...a complete indicator line

Simplified Advance Design. Precision built for longer life. Full jewelled or plain bearings. Shock-cushion models available. No die castings for any moving parts.

Four Series. A.G.D. Groups 1, 2, 3, 4.

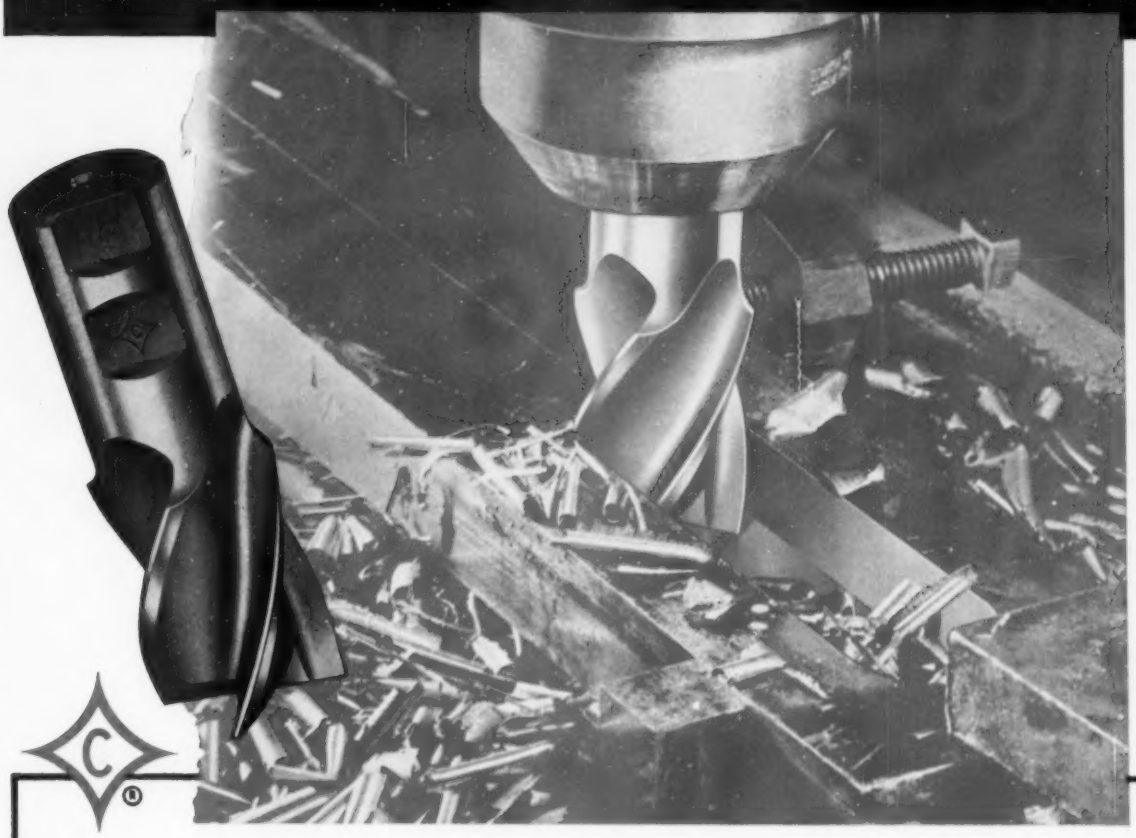
Solid Brass Case. Metal dials have dull-white nonglare background with fine graduations that are easy to read. Both balanced or continuous dials.

Easy Maintenance. Movement is inserted from top. Pivots, gears, rack and pinion are stainless steel for rust and wear resistance.

Always buy from your Lufkin distributor. For complete information on Indicators, write for Catalog No. 51. Lufkin Rule Company, Saginaw, Michigan.

LUFKIN DIAL INDICATORS
TAPES • RULES • PRECISION TOOLS

86% More Slots per Grind



CLEVELAND 500 Series 4-Flute End Mills give Better Performance

On the job illustrated above, conventional 3-flute end mills were averaging 50 slots per grind in SAE 1020 steel. On the same set-up CLEVELAND 500 Series 4-Flute End Mills, with less cutting edge wear and longer size life, increased production to *93 slots per grind.* Yet this is only part of the story. The customer reported that these new CLEVELAND End Mills also gave a smoother finish, greater accuracy and better chip removal *without sacrificing speed or feed.* When you use CLEVELAND 500 Series End Mills you get *all* the advantages of 4-flute mills—and plunge cutting, too! Contact your nearest Stockroom, or . . .

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

for CLEVELAND Quality Tools . . . *prompt delivery from stock*

Request your copy of this helpful, informative book that shows the complete line of CLEVELAND End Mills

THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

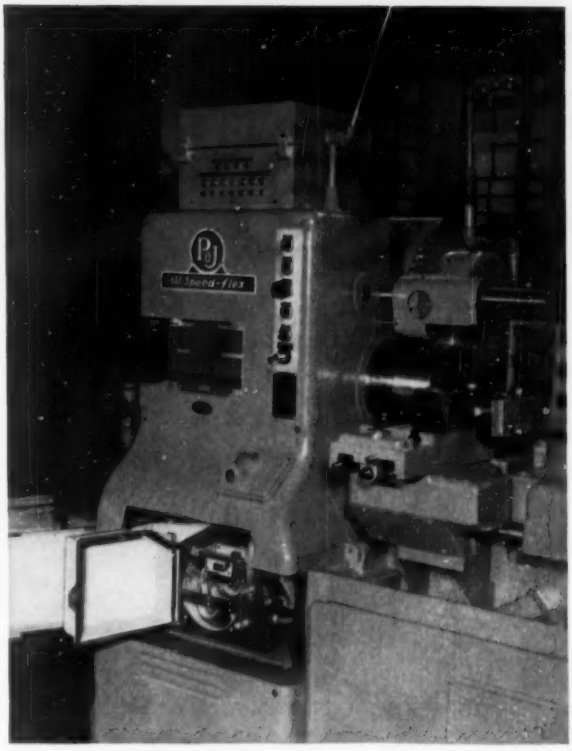
Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58

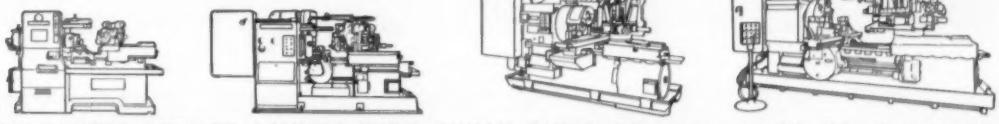
to Automatic Machine Programming

....TAPE CONTROL....

Potter & Johnston Tape Control is a unique new type of control system that makes the advantages of automatic programming available on a practical, economically realistic basis. The very low initial cost of $3,500.00 is possible, because of its simplicity. It is not electronic, and therefore requires no tubes or transistors. Unlike other systems, P&J Tape Control can be easily added to current models of Potter & Johnston Automatics already in the field, in addition to being available on new machines.

Operating under the P&J Tape Control System, all motions of the machine's spindle, turret and cross slides—including all speed and feed changes—are controlled by a quickly prepared plastic tape. As a result of the increased efficiency made possible by this system, a manufacturer using a P&J Tape Controlled Automatic in regular production has already reported savings of 25% in machining and setup time. In addition, the cost-cutting benefits of automatic machining are now made available for many production runs involving 25 pieces or less.



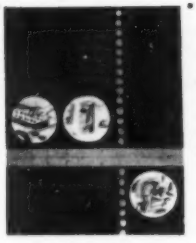


. . . . AUTOMATIC TURRET LATHES WITH CHUCK SIZES FROM 6 INCHES TO 42 INCHES . . . .

POTTER & JOHNSTON

SUBSIDIARY OF PRATT & WHITNEY COMPANY, INC.

PRECISION PRODUCTION TOOLING SINCE 1898



YOU'LL FIND ALL THE TIME-SAVING FACTS . . .

on P&J Tape Control in this new circular. Use the coupon here to send for your free copy. See for yourself how this unique system can provide the practical, simple answer to your profit-building, cost-cutting requirements. Potter & Johnston Company, Pawtucket, Rhode Island

POTTER & JOHNSTON Company, Pawtucket, R. I.

Please send my free copy of Bulletin No. 176 fully describing P&J Tape Control for Automatic Turret Lathes.

NAME_____ POSITION_____

COMPANY_____

CO. ADDRESS_____

CITY_____ ZONE_____ STATE_____

ACCURACY

MACHINING TIME WAS CUT 50% for 10-piece lots of these gear boxes, by changing from manual to tape control. Locations made automatically under tape control are accurate to .0001".

30-HOUR JOB DONE IN 7½, when this precision computer part was machined under Numerical Control. This job involved precision machining at 566 separate locations.

1429 HOLES WITHOUT ERROR, an almost impossible job under manual operation, was completed under Pratt & Whitney Numerical Control with estimated time savings of 41%.

ASSURED...

"P&W NUMERICAL CONTROL HAS PROVED IT WILL IMPROVE **MACHINE UTILIZATION*** 100% AND ELIMINATE ERRORS," says "Jake" Jaeger

**(Time spent cutting metal)*

Mr. J. J. ("Jake") Jaeger, Vice President and Chief Engineer of Pratt & Whitney's Machine Tool Division, states, "Reports from more than 35 successful installations in the field and experience in our own manufacturing conclusively prove that P&W Jig Borers with Numerical Control represent a truly significant advance in metalworking. Users, which include both the giant corporations and shops with less than 10 men, are realizing time savings from 2-to-1 to 6-to-1 – depending on the complexity of the parts – and in addition have improved their MACHINE UTILIZATION time 100%. With this great increase in productivity, the jig borer has truly become a production machine. Used, for example, in our own manufacturing of components, the need for expensive jigs is eliminated, engineering changes are simple and inexpensive – and every production part has the toolroom precision of an original jig.

ADDITIONAL ECONOMIES THROUGH SCRAP ELIMINATION . . .

"With all machine positioning made automatically under Numerical Control, scrap losses from human errors in positioning are eliminated. Freed from blueprint calculating, the operator can concentrate on his primary job – making chips. The result is more and better work, with less fatigue.

VERSATILITY UNLIMITED

"The P&W Jig Borer has also proved that it can handle efficiently and economically an almost unlimited variety of jobs – one-piece jobs, extremely complex jobs, or lot production – in fact, any job that requires drilling, reaming, tapping or boring holes, or milling slots or surfaces."

Summing up the importance of Numerical Control, "Jake" Jaeger continues, "No one can *afford* to overlook the ability of this equipment to increase machine tool utilization and effect economies in his own operations." Experience has proved the truth of this statement, so act today to get all the facts on P&W Numerical Control. Write now for your free copy of Circular No. 609. Pratt & Whitney Company, Inc., 16 Charter Oak Boulevard, West Hartford, Conn.

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

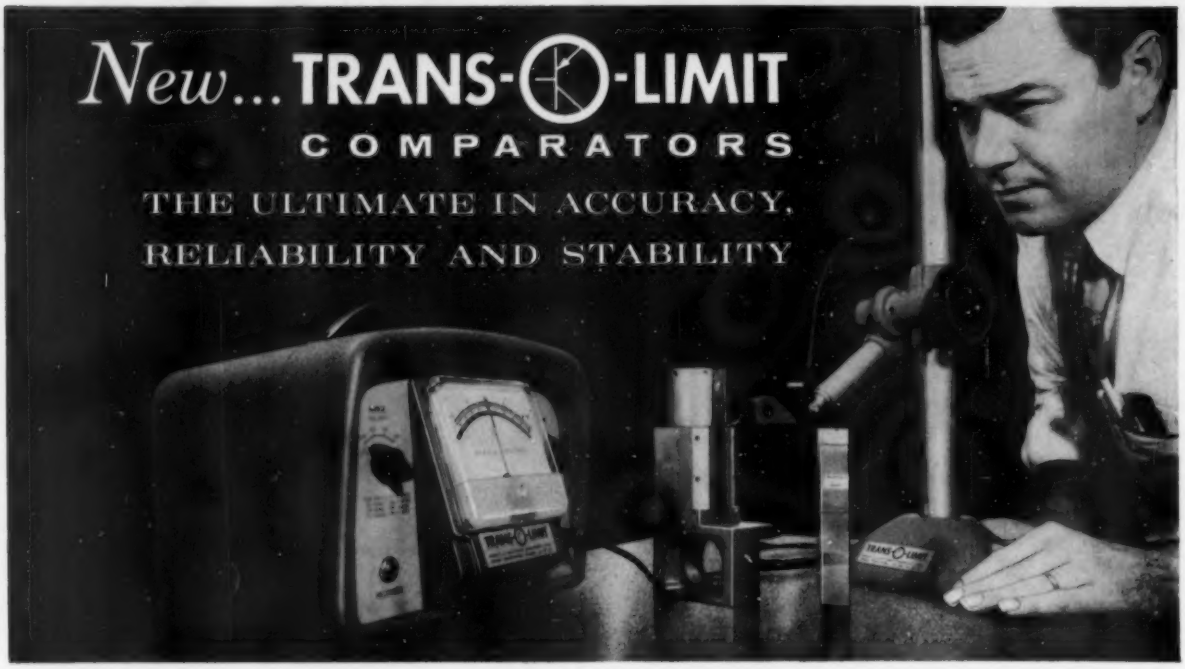
MACHINE TOOLS • GAGES • CUTTING TOOLS

AUTOMATICALLY POSITIONING WORK ACCURATE TO .0001", the P&W Numerically Controlled Jig Borer combines toolroom precision with production-line speed and economy.

SETTINGS ACCURATE TO 5 SECONDS OF ARC are made automatically by the P&W Rotary Table with Numerical Control. Automatic positioning speeds work, eliminates human errors.

PROFILE MILLING ENTIRELY UNDER TAPE CONTROL, the P&W Numeric-Keller produces irregular shapes without the need for any template or model. Accuracy is unusually high.

ACCURACY ASSURED...



Trans-O-Limit Gages are an entirely new line of precision measuring instruments that offer you every advanced design principle and construction refinement that can contribute to gaging efficiency, accuracy and stability. Combining the highest standards for quality and performance with the advantages of a completely transistorized gaging circuit, they offer you:

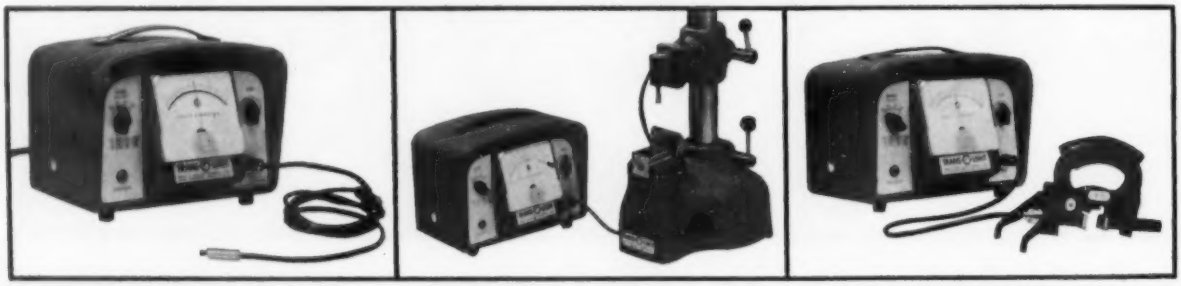
- **4 MAGNIFICATIONS** . . . instantly available. Widest measurement range ever offered. Reads in thousandths, ten-thousandths and millionths!
- **GAGING PRESSURES LESS THAN 1 OUNCE** . . . won't distort the most delicate parts.
- **INSTANT RESPONSE** . . . no lag between work contact and meter reading.
- **OUTSTANDING CIRCUIT STABILITY** . . . not affected by normal voltage and frequency fluctuations.
- **DEPENDABLY UNIFORM READINGS** . . . exclusive P&W "mirror-backed" pointer eliminates errors due to parallax.
- **EXTREME VERSATILITY** . . . combining production-line ruggedness with gage-lab accuracy.
- **FAST, EASY SET-UP** . . . using gage blocks or other master. Setting knob for instant zeroing.
- **5000 CPS OPERATION** . . . allows complete miniaturization and lighter gaging pressures.

***FOR COMPLETE INFORMATION** . . . send for your free copy of Circular No. 623. Pratt & Whitney Company, Inc., 16 Charter Oak Blvd., West Hartford, Conn.*

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS



Versatile Cartridge Units are used in individually designed gaging fixtures to handle a very wide range of specific requirements.

External Comparators combine ruggedness and extreme accuracy. Equally adaptable for final inspections or use at the machine.

Contact Snap Gages used wherever it is more convenient to bring the gage head to the work. Eight frame sizes with 0" to 8" range.

STANDARD MEASURING MACHINES . . . COMPARATORS . . . AUTOMATION AND CONTINUOUS GAGES . . . GAGE BLOCKS . . . CONVENTIONAL GAGES . . . SUPERMICROMETERS

Let's CUT COSTS

on these Secondary Operations

- DRILLING
- REAMING
- TAPPING
- TURNING
- MARKING
- PUNCHING
- GRINDING
- ROUTING
- SAWING
- THREADING

High cost second operations can kill first operation profits. If you perform any of the above secondary operations, better take a critical look at how you do it. There may be cost saving opportunities you've overlooked.

If any one of them involves hand feeding of parts or tools—hand clamping—or mechanical means of performing push, pull or lift motions—The Bellows Co. can save you money.

The Bellows Air Motor and the numerous Bellows packaged pneumatic work units can, in a few minutes, transform hand operated machines and machine tools into fast automatic or semi-automatic production units. They are inexpensive to buy—your own tool room can install them quickly.

Here's how to start—

Write for these two booklets. Bulletin ML-3 and BM-25 will give you a quick picture of what others are doing—of what you can do—in cutting second operation costs. Write Dept. TE-359, The Bellows Co., Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ontario.

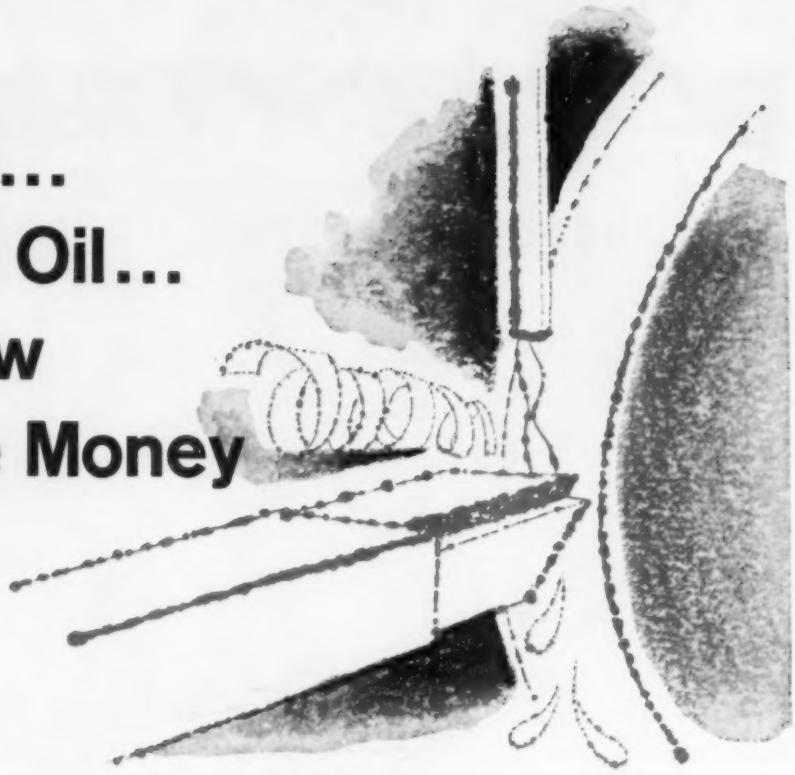
The Bellows Co.

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION

AKRON 9, OHIO

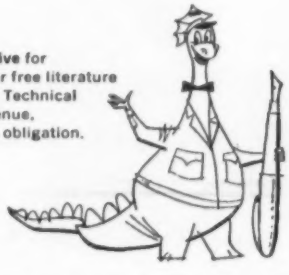
894-B

Turning... Cutting Oil... and How to Save Money



You can cut costs by switching to the one oil that does the job of two—Sinclair Clairo Oil. This dual-purpose oil has earned a reputation as both a cutting oil and a machine tool lubricant. Moreover, you use the same Clairo Oil for cutting ferrous and non-ferrous metals, eliminating changeover and contamination. Tests prove Clairo Oil gives up to 200% greater tool life. Next time management asks how you've cut costs, tell them you're using Sinclair Clairo Oil—and show them the results.

Call your Sinclair Representative for further information or write for free literature to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. There is no obligation.



SINCLAIR
Clairo® Oils

DIES TO WORK MICA AS PRECISELY AS THIS

require the critical inspection that only the Kodak Contour Projector provides.

SPECIAL HIGH-PRECISION DIES are needed to stamp out an intricate mica blank like this, used for positioning electronic tube elements.

Tolerances are on the order of ±0.0002". In making such dies the firm of Schneider and Marquard, Inc. (specialists in punches and dies for precision mica products) was not satisfied with the accuracy limitations of ordinary inspection methods, and turned to *optical* inspection.

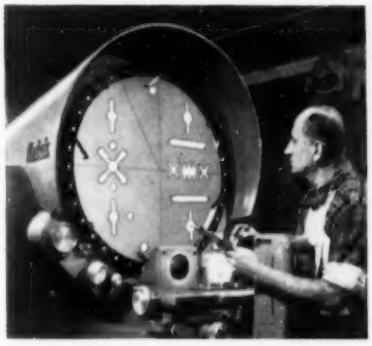
Even then, they found that only one instrument could provide the extremely precise degree of inspection needed, with unparalleled accuracy on all parts of the screen image. That instrument was the Model 30 Kodak Contour Projector.

Accuracy, plus . . . With this large-screen (30-inch) comparator you get a projected image that's as *free* from distortion as the science of optics will permit—accuracy on *every* inch of the viewing screen, including the very edges.

You get a sharp, high-contrast image that's erect and unreversed at all magnifications. Changes in magnification can be made at the flick of a switch.

More refinements . . . You also get efficient head-on surface illumination and a full 16" throat clearance between collimator lens and front mirror. This clearance is constant at *all* magnifications, permits staging of large parts without repositioning. The many other advanced refinements, extreme optical stability, and rugged construction of the Model 30 Kodak Contour Projector make it a leading choice for large-screen precision micrometry or routine gaging.

Cut inspection costs . . . Along with accuracy, optical gaging with Kodak Contour Projectors offers you savings in tool costs, increased inspection rates, and the economies that result from a minimum of operator training.



You can use optical gaging almost anywhere in your plant . . . receiving, assembly, production, inspection, or toolroom. There are 6 Kodak Contour Projectors to choose from, one matched to your inspection needs.

Get all the facts. Write to:

Special Products Sales

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

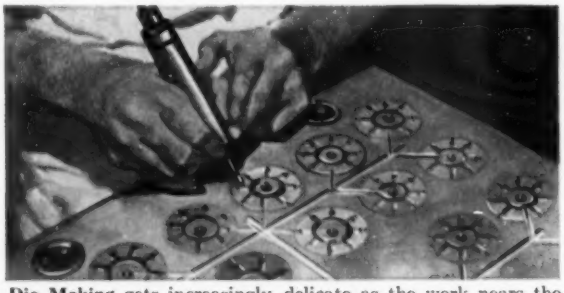
the KODAK CONTOUR PROJECTOR

Kodak
TRADE MARK

Toolmaker's Skill is the marvelous science of making things fit.

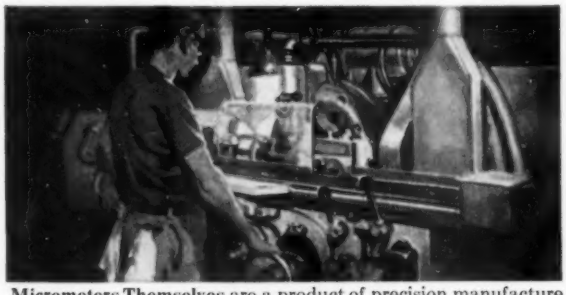
Making tools for toolmakers

Gage Blocks, so important to toolmaker's precision measurements, obtain their own close accuracy through the use of Norton lapping machines. Norton lappers are among industry's most valuable "fit and finish" tools.



Die Making gets increasingly delicate as the work nears the finish. Here the toolmaker adds his final touch, using a Norton tiny grinding wheel — preferred because his work must be perfect.

Touching Up a high speed milling cutter is often done with an India brand oilstone file. Final honing is frequently done with an Arkansas oilstone file. Norton and its divisions are the important sources for both.



Micrometers Themselves are a product of precision manufacture and precision-prepared abrasives. Here a man is grinding a micrometer thread die with a Norton V-face grinding wheel. There are more than 200,000 types of Norton grinding wheels.

Making better products...

puts a man on his mettle

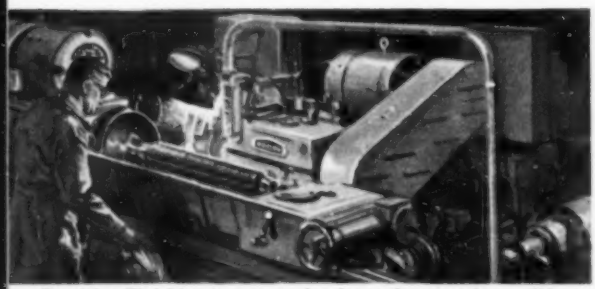
Inventing a tool to make other tools better was the work of an unknown prehistoric genius. A nice start!

Thousands of years later — here at Norton Company — a constant improvement of tools for more efficient production is still going on. Bigger, better and more important as science opens new vistas. Based on this invention, toolmaking has become a great industry serving all industry.

Norton abrasives are chief among "toolmakers' tools" — respected and preferred wherever toolmakers are at work. It is this craft of the toolmaker that turns the designer's ideas into practical production implements.

On this page are a few of the many modern ways in which Norton helps the man who uses the micrometers. Further along — on the production line — Norton abrasives keep the work coming out as it should. This is how Norton serves — making better products . . . to make your products better.

NORTON
ABRASIVES



Precision Finishing to extremely close tolerances is possible on this large Norton grinding machine. Precision engineering gave it a "feather touch". Here a machine spindle is being finished to an accuracy of plus or minus 1/10 of a thousandth of an inch.

Around the world and still expanding

Grinding Wheels Plants — Worcester, Mass.; Santa Clara, Calif.; Hamilton, Ontario; South Africa; England; France; Germany; Italy; Brazil.

Behr-Manning Plants — Coated Abrasives and Pressure-Sensitive Tapes — Troy, N. Y.; Canada; Australia; France; Northern Ireland; Argentina; Brazil.

Abrasive Plants — Huntsville, Alabama; Chippawa, Ontario; Cap-de-la-Madeleine, Quebec; Brazil.

Grinding and Lapping Machine Plant — Worcester, Mass.

Refractories Plant — Worcester, Mass.

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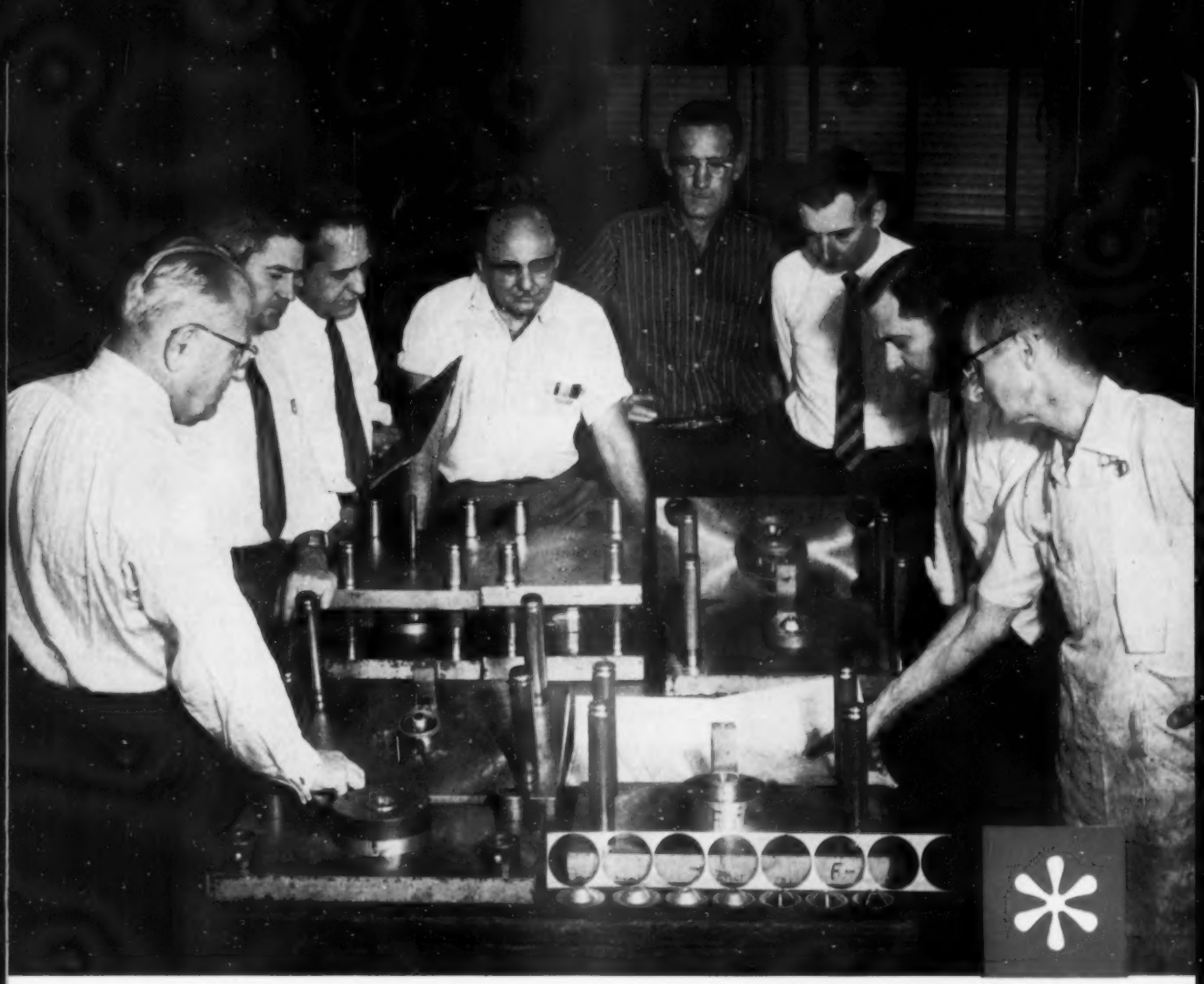
Bauxite Mines — Bauxite, Arkansas.

General offices: Norton Company, Worcester, Mass.

to make your products better



Do you know these tooling specialists?

If you don't, you should. On any tooling problem requiring high-precision gages, dies, jigs, fixtures or special machinery, they can save you time, money, headaches. They can keep you out of production jams... *or pull you out.*

These eight men* represent over 200 years of the choicest, most specialized tool-and-diemaking experience in America. Strong words? Well, consider these facts:

They direct what leading manufacturers in the electrical, appliance, automotive, ordnance and other industries acknowledge is the best-manned, best-equipped toolmaking facility on the Mississippi. Best-manned, because Ehrhardt has over 50 veteran tool-and-die makers and designers, many of them trained here. Best-equipped, because there isn't an important late-model precision machine tool or device (jig borers, jig grinders, profile grinding, electrical discharge equipment, etc.) which you won't find at Ehrhardt.

If you need close-tolerance work—whether it's a gage that takes 40 hours or less to produce or a complex lamination die requiring several thousand hours—you will be doing yourself a favor to get to know these men, to observe their skilled craftsmen and their unparalleled facilities.

You can do this by visiting the Ehrhardt plant, and you are cordially invited to do so. In the meantime, write for a copy of TRIPLE PLUS (the three plusses: "Precision Skills, Full-Range Facilities, Unique Experience"), a twenty-four page illustrated brochure which will convince you why knowing these tooling specialists can be worth your while.

Ehrhardt Tool & Machine Company

914 Monroe Street, St. Louis 6, Mo.

"A Nation-wide Service to the few who want the most in high precision gages, dies and fixtures."

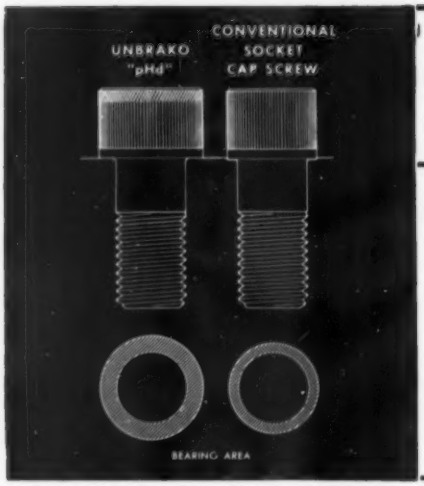
Ehrhardt/St. Louis

*

EHRHARDT/ST. LOUIS PLANNING COMMITTEE—left to right: Willis G. Ehrhardt, president; Charles Hawkins, general manager; Bill F. Boyd, purchasing agent; Ed Humm, shop superintendent; Ed Deuser, shop foreman; Joe Poletti, chief tool designer; Bud Graser, sales engineer, and Tony Wieclaw, veteran tool and die maker.

SPS RELIABILITY / *A dynamic standard of predictable performance*

Larger head diameter of UNBRAKO pHd* socket cap screws increases load-carrying capacity up to 233%



COMPARISON OF UNBRAKO pHd AND CONVENTIONAL DESIGN

Each size can now be utilized with equal reliability. The bearing stress is consistent from size to size in the new UNBRAKO pHd socket cap screws.

SCREW SIZE	HEAD DIAMETER (in.)		BEARING AREA (sq. in.)		LOAD TO INDENT IN CAST IRON (lb.)		% INCREASE USABLE STRENGTH	TIGHTENING TORQUE (lb.-in.)‡	
	Old	pHd	Old	pHd	Old	pHd		Old	pHd
¼	.375	.375	.041	.041	3,280	3,280	—	165	180
5/16	.438	.468	.047	.072	3,760	5,760	54	325	360
⅜	.562	.562	.102	.102	8,150	8,150	—	600	660
7/16	.625	.656	.116	.148	9,270	11,800	27	1,000	1,040
½	.750	.750	.188	.188	15,000	15,000	—	1,450	1,590
5/8	.875	.937	.203	.305	16,200	24,400	51	2,900	3,190
¾	1.000	1.125	.223	.432	17,800	34,600	94	5,050	5,600
⅞	1.125	1.312	.254	.594	20,300	47,500	134	8,000	8,900
1	1.312	1.500	.364	.785	29,100	62,800	116	10,550	13,600

*Proper Head Design—a factor in higher product reliability.

‡Normal recommended seating torques for unplated screws, fine threads.

For you, pHd means sounder fastening, with resultant increases in product reliability at no increase in price. With pHd UNBRAKO socket cap screws you get stronger, more reliable joints; space and weight saving through use of smaller or fewer fasteners; greater fatigue resistance through application of consistently higher preloads; fewer fasteners working loose under vibration or shock; and elimination of washers under cap screw heads in many applications.

The principal reasons for the superior performance of broad-bearing pHd UNBRAKO socket cap screws are up to 233% more load-carrying capacity than with a conventional cap screw and the ability to be tightened tighter. Because of increased bearing area, the vital preload that keeps screws tight and prevents fatigue failures is distributed over more of the bolted material. Indentation under high working load is eliminated. And pHd UNBRAKO screws have been designed for high tightening. In many cases the socket has been enlarged for better key engagement. Combined with this feature is the fact that all the tightening force is used to preload the screw, in contrast with the conventional cap screw—where indentation saps some or all of the tightening force.

See your authorized SPS industrial distributor for complete details. Or write SPS—manufacturer of precision threaded industrial fasteners and allied products in many metals, including titanium. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

SPS **Jenkintown • Pennsylvania**

Standard Pressed Steel Co. • The Cleveland Cap Screw Co. • Columbia Steel Equipment Co. • National Machine Products Co. • Nutt-Shel Co. • SPS Western • Standco Canada Ltd. • Unbrako Socket Screw Co., Ltd.

WHAT CAN THIS TAP IDENTIFICATION MEAN TO YOU?

The marking is conventional . . .
with the exception of BAY STATE and S

S identifies a specific Bay State taper pipe tap. You are assured optimum performance for tapping steel, aluminum and other stringy material when you order this Bay State high speed, ground thread, pipe tap FOR STEEL.

As tapping specialists, Bay State sales engineers can provide you with complete application engineering on pipe tapping or any tapping problem. And . . . full line inventories of distributors across the nation assure prompt delivery.

Write for detailed information on tapping taper pipe threads or see page 40 of Bay State Catalog 56.

On the nearby shelves
of your Industrial
Supply Distributor

BAY STATE TAPS

Bay State Tap & Die Company • Mansfield, Massachusetts

TROUBLE-SHOOTING
THREADING PROBLEMS

thread taper

THE PROBLEM

Did you ever try to correct a tapering condition, and then, after getting into even more trouble, find out that it wasn't true taper at all? It sure can happen. Here's why:

TRUE TAPER

True taper involves taper of roots, crests, flanks and pitch line together (Fig. 1). It is usually eliminated by checking a.) machine alignment, b.) tight fitting yokes on revolving die heads, c.) regrinding chasers, or using floating holders.

FALSE TAPER

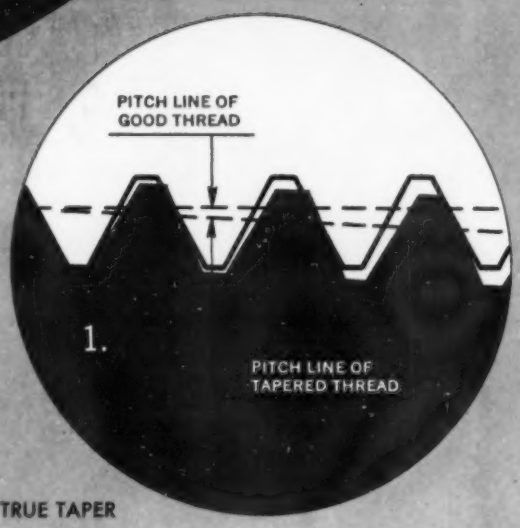
However, false taper which involves side trimmings of flank angles is often the real culprit. When measuring over the crests you certainly can get the impression of taper (Fig. 2). The cause is usually poor tooth spacing on the chaser and improper tracking, which produce a series of ridges on the flanks.

HOW TO CORRECT IT

The best correction for FALSE TAPER (side trimming) is the use of J&L die heads and chasers because: **a.)** The thread form is ground on the chaser *after hardening* to eliminate heat treating distortion. This assures proper spacing and chaser tracking. **b.)** The thread form is also ground on the *exact* helix angle for the diameter and pitch of thread to be cut. This produces true thread form and accurate lead control —with *no* approximations. **c.)** Top rakes and point heights are easily altered for the best cutting action on a given material. **d.)** The die head has the rigidity and "beef" to hold the chasers in proper position in spite of cutting pressures.

OUR OFFER

We solve threading problems. Send us yours—no obligation.

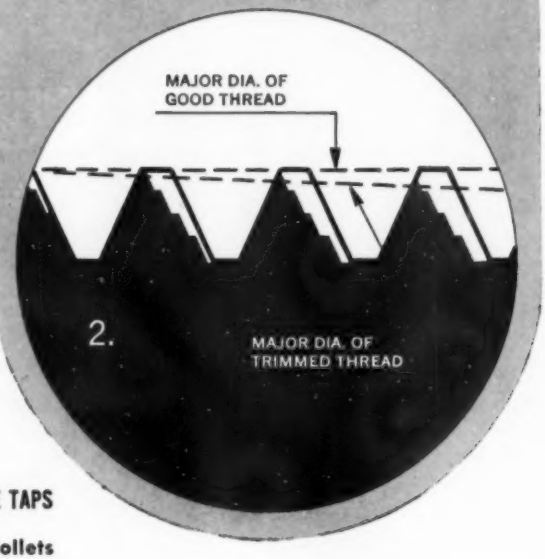


TRUE TAPER

Thread Form stays intact. Both roots and crests of threads are undersize.

FALSE TAPER

Flanks are trimmed. Crests are undersize, while root diameter remains constant.



TANGENT & RADIAL DIE HEADS • COLLAPSIBLE & SOLID ADJUSTABLE TAPS
also
Self-opening Stud Setters • Modern-Magic Chucks and Collets
Precision Boring Machines

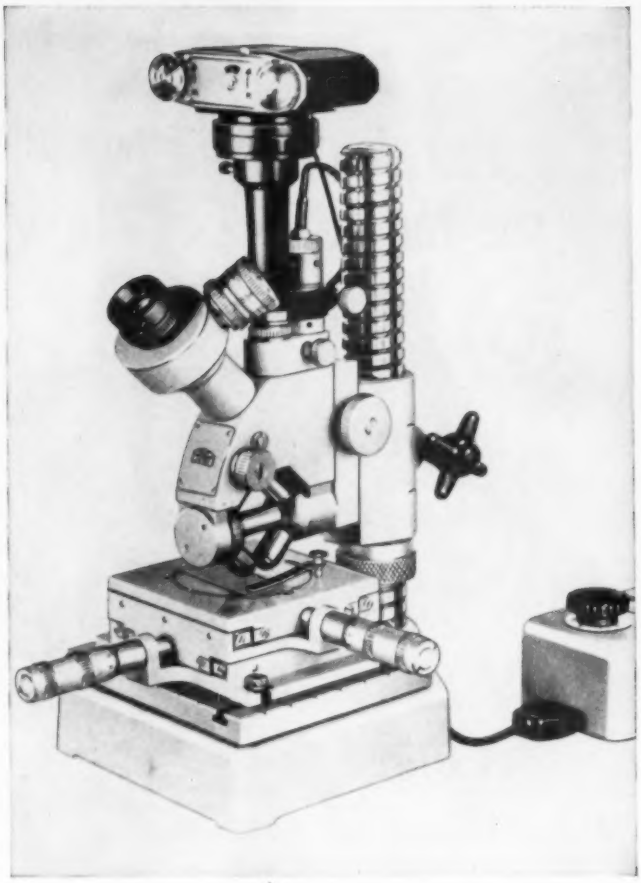
JONES & LAMSON

THREAD TOOL DIVISION

Jones & Lamson Machine Company, 518 Clinton Street, Springfield, Vt., U. S. A.

CARL ZEISS
WEST GERMANY

Light Section Microscope



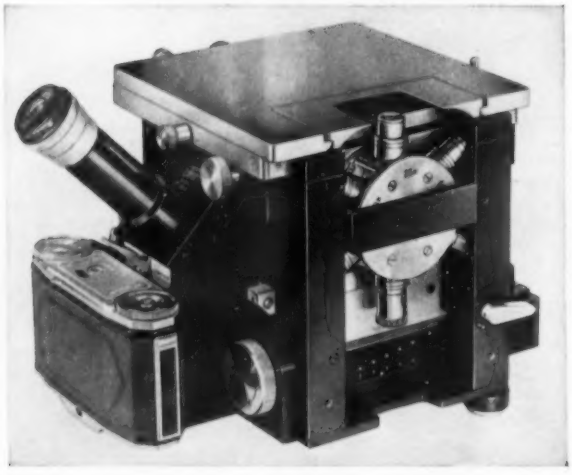
This microscope produces a profile of the surface being examined by the well known light-section method. Roughness depth, as well as the groove distances of machine-finished surfaces, can be measured. Internal surfaces can be examined by making *lacquer replicas.*

The newly developed revolving nose-piece for the objectives makes it possible to quickly change the magnification (height of profile) between 400x and 200x. At 400x, depths of roughness of 40 to 160 micro inches can be measured; at 200x, those of 120 to 4,000 micro inches.

Photographs for comparison and control purposes can be taken by mounting a 35mm miniature camera at top of the instrument.

In addition to the stage plate of the stand, a mechanical stage and center cradle (for turned parts) are available.

Interference Microscope



for measuring minute depths of roughness

(80 to 1.2 micro inches)

This instrument, which has magnifications of 80x, 200x, and 480x, is designed especially for critical examination of super-finished surfaces, thickness of coatings, changes of surface structures due to wear, impact, stress, strain, corrosion, as well as for the studying of polished and etched metallurgical specimens.

It is equipped with built-in Thallium and white light illuminators.

A miniature camera, which is attached, provides photographs on 35mm film (1x1½").

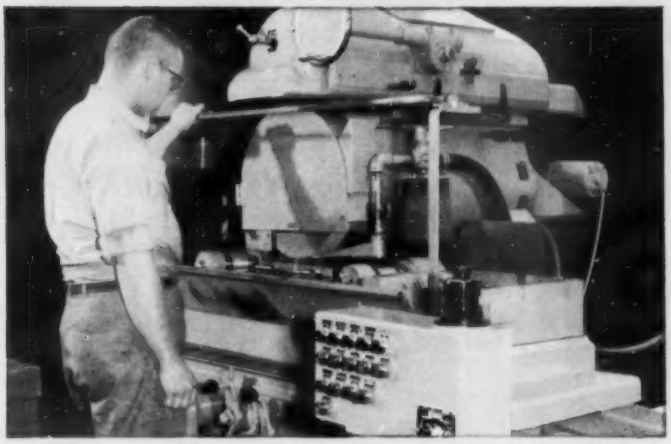
Write for detailed literature on these instruments

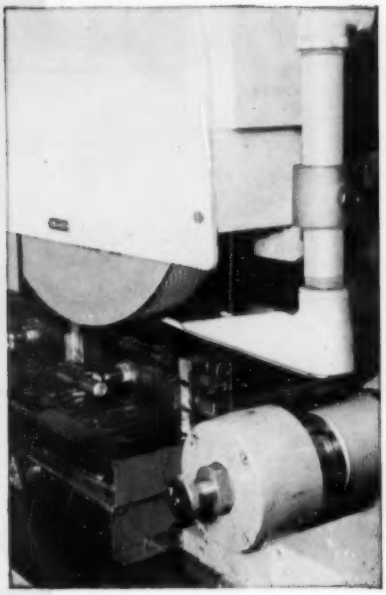
CARL ZEISS, INC.
485 FIFTH AVENUE, NEW YORK 17, N. Y.

GUARANTEED UNINTERRUPTED REPAIR SERVICE

Thompson — TRUFORMING CUTS COSTS 66%

. . . DOUBLES PRODUCTION AND IMPROVES PRODUCT AT THE OLIVER CORPORATION





In the production of ledger plates, used in the cutter bar of mowing machines, The Oliver Corp. of Chicago, formerly first milled the teeth, then hardened the plate. The hardening process caused distortion and variance in uniformity which impaired the cutting action of the bar.

On the advice of Thompson engineers, a Type BB Truforming Grinder with a 2½" width grinding wheel was installed to process these ledger plates as a finished grinding operation. The plates are now heat treated first and the teeth are then formed by grinding.

The installation of the Thompson Truforming Grinder has accomplished the following results:

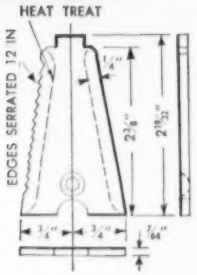
1. **Cut total production costs from $3.18 to $1.06 per 100 pieces.**
2. **Increased the production rate from 1600 to over 3600 pieces per 8-hour shift.**
3. **Provided constant uniformity in the workpieces.**
4. **Eliminated the full-time service of one man.***
5. **A pair of $160.00 milling cutters formerly produced 20,000 pieces. A $60.00 grinding wheel now produces well over 40,000 pieces.**

The leadership of Thompson Truforming Grinders results from 25 years of research and development work in crush form grinding. Today these machines are opening up hundreds of practical, time-saving, profit-improving and cost-cutting applications for industry.

Thompson's engineering experience is available to you without obligation. Write for Catalog T558.

**Automatic machine cycle allows operator time to countersink hole in plate—an operation formerly requiring one man's full time.*

THE THOMPSON GRINDER CO.
SPRINGFIELD, OHIO



LEDGER PLATE
High Carbon Manganese Steel
Rockwell C52-58

"Keep Thompson in mind for that daily grind"

Thompson SURFACE GRINDERS

NOW

FOR DRILLING and CHAMFERING PRIOR TO TAPPING

IMMEDIATELY AVAILABLE—

ALL PRACTICAL SIZES—IN 3 STEP LENGTHS 3 SHANK STYLES

with Straight Shank, Tapered Shank or Jobbers Length

Just off the press! This new 12-page Catalog illustrates the multiple advantages of Drilling and Chamfering (prior to tapping) with Mohawk Standard Subland Drills. Lists all practical sizes, types and suggests a simplified method of determining your requirements—more economically. Yours for the Asking!

Standard
SUBLAND DRILLS
IN LOCAL STOCKS

Now . . . Mohawk Subland Drills are manufactured in *all* practical *standard* sizes, in 3 step lengths and 3 shank styles—to meet all drilling-chamfering requirements. And, Mohawk Standard Sublands sizes match accepted industry practice on unified thread sizes, hole tolerances, etc.

Why? Because Mohawk Standard Sublands affords a faster, more accurate, economical method of simultaneously drilling and chamfering clean, concentric holes for better tapping operations—plus a saving in tap costs.

Mohawk Standard Subland Drills are available direct from your local distributor's stock—immediately! Start saving production time and equipment dollars today. Call the Mohawk man right now!

worlds largest producer of Sublands

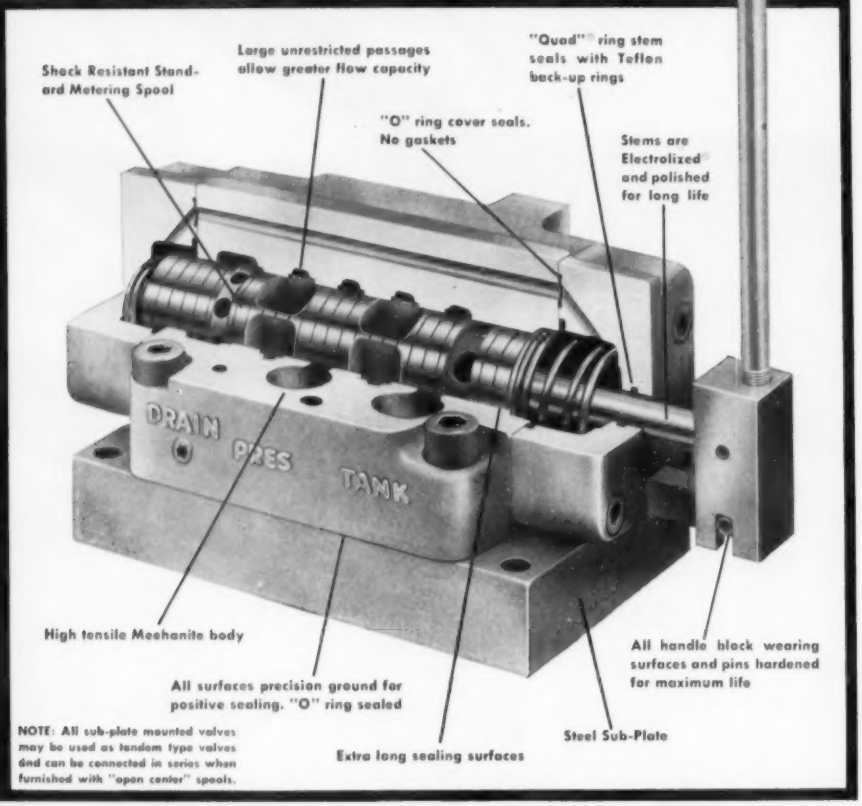
Mohawk TOOLS, Inc.

MONTPELIER, OHIO

Rivett announces a new line of

HYDRAULIC VALVES

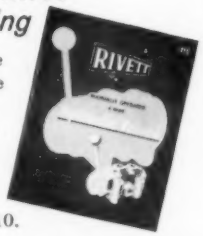
3000 PSI; sub-plate mounted; manually operated



Reliable performance through precision manufacturing

Rivett Series 6100 Hydraulic Valves are the latest in design, furnishing accurate, positive control of hydraulic power. Developed by engineers long experienced in fluid power, these valves offer economical, efficient operation as well as trouble-free maintenance and long-life. Featuring unrestricted passages to permit greater flow capacity, the 1" size in the Series 6100, for example, is rated at 28.2 gpm at 15 ft. per sec. Piston action is noted for smooth, positive opening and closing.

New catalog simplifies selection and ordering



Rivett's new easy-to-use Valve Catalog No. 210 puts complete information on performance, ratings, dimensions, mountings and ordering instructions at your finger tips. Write today for your copy of Catalog No. 210.

The better you know hydraulics . . . the better you like →

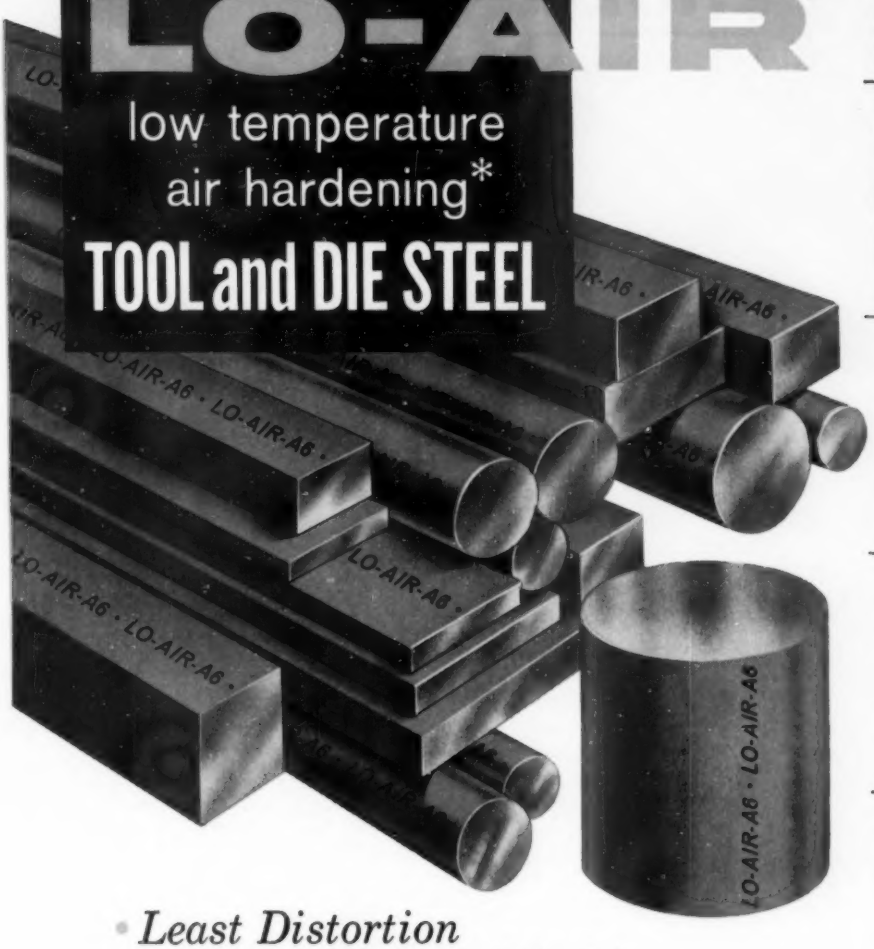
RIVETT, INCORPORATED, DEPT. *TE 3*
Brighton 35, Boston, Massachusetts
Member National Fluid Power Association

RIVETT
HYDRAULIC VALVES

Announcing...

LO-AIR®

low temperature
air hardening*
TOOL and DIE STEEL



- *Least Distortion*
- *Easy to Machine*

New from Universal-Cyclops, LO-AIR is an air hardening tool steel remarkably free from distortion in hardening. Even more remarkable is its ease of machining. Now you can combine the simplicity of hardening and ease of machining typical of oil hardening tool steel (AISI 01) with the safety of an air hardening grade. Write for our descriptive brochure No. TS-101, or better yet order a bar from your nearest Universal-Cyclops sales office or warehouse. Complete stocks are available.

**U. S. PAT. NO. 2,355,244*

UNIVERSAL CYCLOPS
STEEL CORPORATION
BRIDGEVILLE, PA.

TOOL STEELS • STAINLESS STEELS • HIGH TEMPERATURE METALS

BLANKING
STAMPING
TRIMMING
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EMBOSSING
PUNCHING
PIERCING

For Accuracy In Your Spring Steel

Use UDDEHOLM

The Spring Steel Used To Measure Accuracy

Feeler Gages are used as a *standard* of accuracy—good reason why so many of them are made from Uddeholm spring steel. Their own tolerance limits are extremely close—and feeler gage manufacturers have long depended on Uddeholm to supply this accuracy.

Uddeholm feeler gage steel is typical of the quality you can expect from *all* Uddeholm spring steels—not only in dimensional accuracy, but in superior flatness, straightness of edge, and surface and edge finish. In performance too, Uddeholm spring steel will give your product longer life, greater fatigue resistance.

From Warehouse Stocks...

Uddeholm spring steels are available annealed or hardened and tempered in a wide variety of grades, sizes, tolerances and finishes. Widths run from $\frac{1}{8}$" to $16\frac{1}{4}$"; thicknesses from .001" to .125". Slitting, edge-filing and heat treating facilities are also available at warehouse.

UDDEHOLM SPRING STEELS

Annealed Clock Spring Steel
Camera Shutter Blade Steel
Doctor Blade Steel
Knife Steels
Razor Blade Steel
Reed Steel
Rule Steel
Saw Steels
Tape Steels
Tempered Spring Steels
Tempered Clicker Die Steel
Textile Steels
Thickness Gage Steels
Trowel Steels
Valve Steels

Uddeholm Spring Steel Quality Guarantees you...

- Maximum Fatigue Strength
- Uniform Hardness
- Accurate Dimensions
- Fine Micro Finish
- Excellent Wear Resistance

Write For Our New Spring Steel Stock List and General Catalog.

UHB

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Cold Rolled Spring Steels

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with **DUMORE** VERSA-MIL®

PORTABLE PRECISION MACHINING

BASIC UNIT only $565 *

Feed Table Accessories at extra cost

*FOB RACINE

Basic Unit and 7 Attachments Lets You Do All These Jobs — *and more*

milling	reaming	external grinding
boring	routing	internal grinding
shaping	polishing	surface grinding
slotting	chamfering	thread grinding
drilling	beveling	tool grinding
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Dumore Versa-Mil machines efficiently in any position — as an independent unit with its own power and feeds or attached to planers, shapers, millers, grinders, and lathes. Its use eliminates moving the workpiece. Saves handling, set-up, and down-time.

Designed throughout to machine tool specifications, it provides a rugged machining unit which can be taken to the work instead of bringing the work to the machine. And, when you *take the machine to the work, you* . . .

- **machine where it is most economical**
- **eliminate down-time and set-up expense**
- **reduce substantially your overall machining costs**

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Basic unit mills, bores, drills, reams and faces at 13 variable speeds from 44 to 450 rpm. Converts lathes into complete machine shops.

Combined with accessories, it shapes, slots, thread mills, cuts, grinds (external, internal, surface and thread) and other operations at speeds from 33 to 18,000 rpm.

HIGH SPEED CUTTING HEAD
For drilling, reaming, boring, routing and small diameter end millings. Speeds 540 to 5500 rpm. **$160***

UNIVERSAL HEAD
For side milling large diameter workpieces. Also thread milling. Provides 360° cutter adjustment on face of Basic Unit. **$225***

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For internal keyway slotting, shaping and cutting in bores as small as ½" dia. Cuts up, down or sideways with ⅛" to ½" wide cutters. Stroke adjustable to 5". **$275***

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External unit for wheels from 3" to 6". Uses flat vibration-free belts for speeds to 6900 rpm. **$180***

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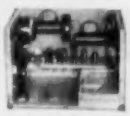
Two or three bearing spindles for depths to 14", Wheels from ⅞" to 4" diameter. From **$180***

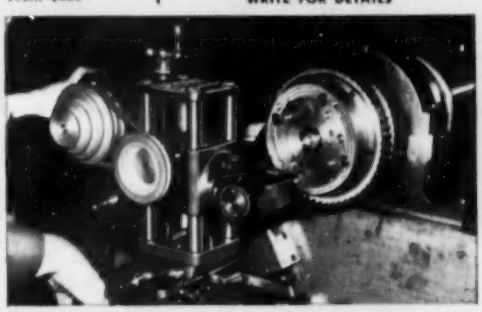
INDEX HEAD
For attaching to and indexing a lathe spindle or face plate. All divisions, 1 to 50. **$197.50***

FEED TABLES
Provide longitudinal and in-feed movements. Four sizes for feeds 3⅜" to 42½", only 3¾" high. From **$260***



SHOP CABINET—SHIPPING CASE
Holds accessories and Basic Unit in one compact, attractive storage case. **$65*** with basic unit.

ADDITIONAL ACCESSORIES AVAILABLE... WRITE FOR DETAILS



ALCO MACHINE & TOOL CO., Cleveland, Ohio, saved three days dismantling time . . . by taking Dumore Versa-Mil, Universal Head and Feed Table to repair this Airfoil Machine in place.

Job Facts:

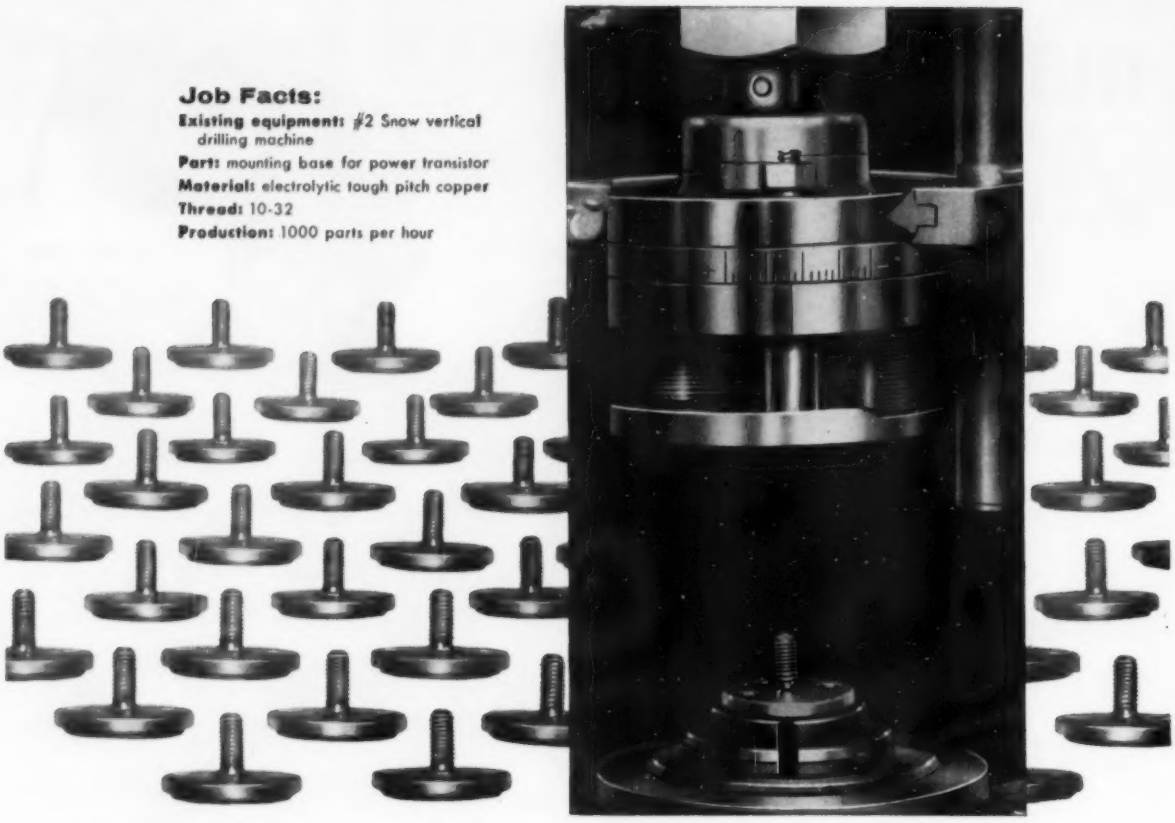
Existing equipment: #2 Snow vertical drilling machine

Part: mounting base for power transistor

Material: electrolytic tough pitch copper

Thread: 10-32

Production: 1000 parts per hour



ONE *Acme-Fette Thread Rolling Head*

Thread Rolls 5,000,000 Pieces

without major investment

"A standard thread rolling machine would cost from seven to eight times more money than is invested in our Acme-Fette Thread Rolling Head *and* the existing equipment on which it is installed", says H. M. Oshry, Vice President of Steel Industries, Inc., Crawfordsville, Indiana.

The extremely rugged head achieved this outstanding production record with only three sets of thread rolls, producing threads with consistently closer tolerance and uniformity. A higher tensile strength is also obtained, and the resulting surface hardening provides a surface quality not achieved by any thread cutting method.

Acme-Fette Heads roll all parallel thread forms from 1/16" to 2" at speeds equal to turning speeds with high speed tools . . . up to 5 times faster than conventional thread cutting. For cost reducing ideas showing how you can put these heads to work on your *present* equipment, send for Bulletin NAF-57A.

National Acme

The National Acme Company
193 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

Investing in the Future

I read years ago that "A man who never does any more than he gets paid for never gets paid for any more than he does." Elbert Hubbard is credited with this bit of wisdom, and it is too bad that its truth isn't recognized more widely.

If more young men understood the importance of Hubbard's observation, they would be less easily misguided by some of today's so-called leaders. If we want more out of life, we must be willing to put more into it. We are frequently told that we can't get something for nothing but sometimes, if we give something for nothing, it is returned manyfold.

A chap asked me the other day, "What in the world do you get out of this ASTE work you spend so much time on? You don't get paid for it, do you?" Of course, Hubbard supplied the answer. I am sure that every officer and committeeman believes as I do in its fundamental truth. I am sure we have been amply rewarded by the many friends gained, and the experience is priceless.

Although you may think my halo is supported only by my ego, I personally think it is a good philosophy to live by. I have seen many men fall by the wayside because they declined to do things that weren't their job or that they weren't paid for, not recognizing that compensation often appears in forms other than monetary returns.

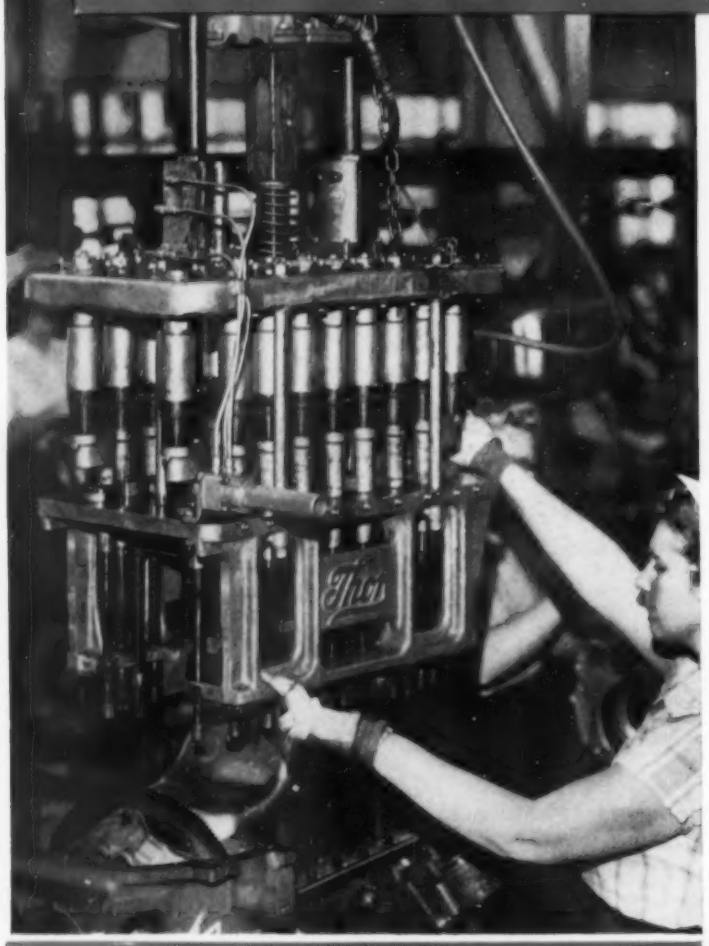
The contribution we can all make to the future would be to practice the philosophy of service and to encourage our children and business associates to do the same.

PRESIDENT

American Society of Tool Engineers

If you run two or more fasteners at the same time—cut costs with

THOR MULTIPLE NUTSETTERS AND SCREWDRIVERS



Now, thanks to Thor multiple nutsetters and screwdrivers, the largest to the smallest assembly operation can enjoy the cost cutting benefits of automation. If you have production assembly jobs involving 2 to 20 or more nuts or screws, Thor multiples can return their cost in labor savings, in improved quality control, time and time again.

Running multiple fasteners at one time means every fastener is tightened to identical torque simultaneously with no shift in tensile load equilibrium which occurs when fasteners are tightened one at a time.

For the complete story of how Thor multiples can help you, write today for Thor's free book "Automation in Assembly." Thor Power Tool Company, Aurora, Illinois.

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PORTABLE POWER
TOOLS

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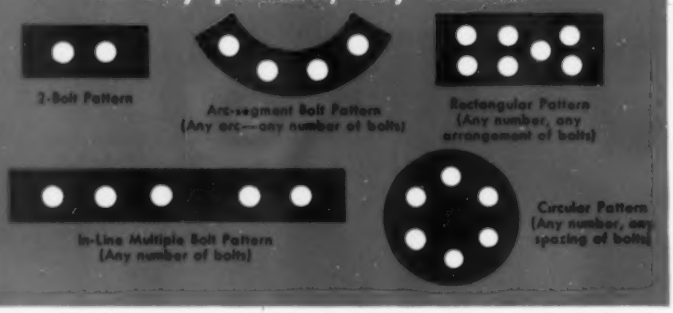

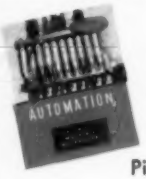

FREE

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evaluating TOOL LIFE

By D. Peckner and H. Ginsburg

Materials Engineering Depts.
Westinghouse Electric Corp.
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Statistical methods when applied to tool wear testing can predict performance quickly. The authors describe a useful technique and illustrate the principles with a report of a study performed on form cutters used to machine slots.

USING A TOOL STEEL because of habit or preference may prove costly—costly in the sense that the steel may not perform well or may be too expensive for the application. A definitive test is useful for determining the wearability of various grades of tool steel. In the absence of a standard test for the evaluation of form cutters used in the production of generator rotors, statistical analysis has been applied to wear data to aid in determining the appropriate tool steel to use.

Tool Life Test: Form-cutters were used to machine the slot grooves on different rotors, *Fig.* 1, measuring both the total length of slot grooves cut by each tool and the change in diameter of each tool after each slot groove was cut. Total length of cut offers a qualitative estimate of the tool life, while change in diameter gives a more quantitative estimate.

The original program was to use the form-cutters on eight rotors. Due to a shift in production patterns, however, only two rotors were available. Two tools were made from each type of tool steel used, and each tool was paired with its mate when the tests began to allow testing of the tools under similar conditions. The purpose of the pairing was to eliminate some of the variability of the test. Each pair of tools cut two grooves for each tool in the same rotor. The tools were then removed from the toolholders and another pair substituted. No one pair of tools was run to destruction on one rotor. The rotors used were the same type of steel but were purchased from different companies and were made from different heats of steel. By using a pair of tools on both rotors, differences in observed tool life caused by a variation in composition of material being cut were eliminated.

The form-cutter mills a "Christmas-tree" wedge

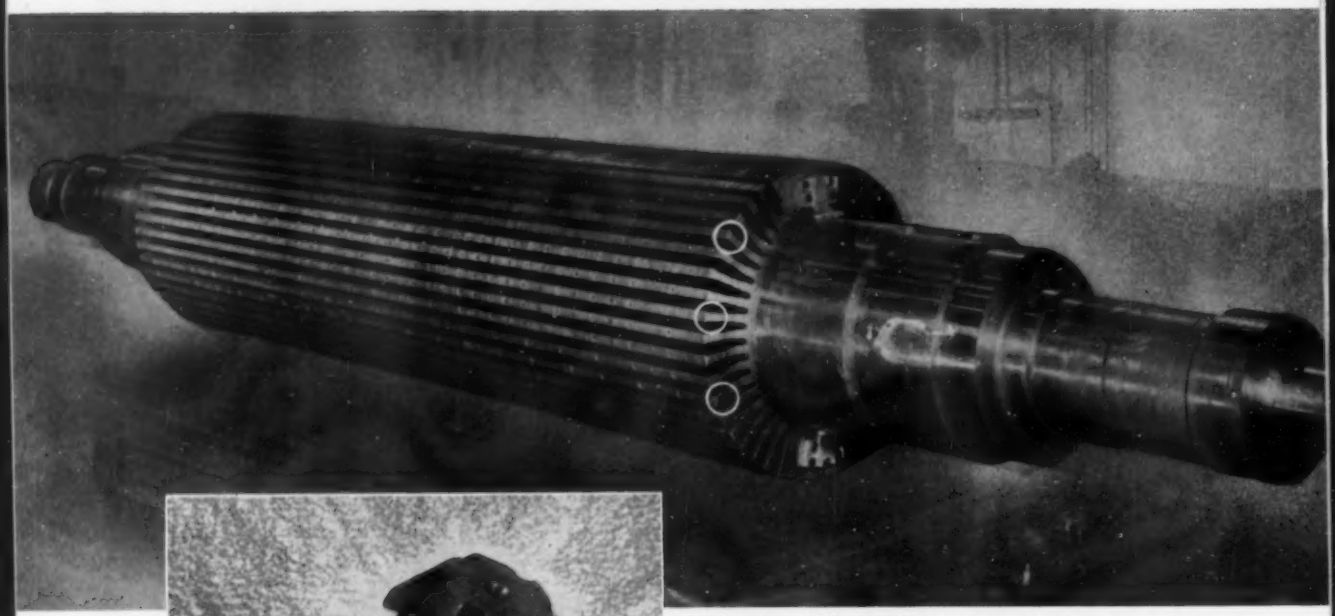


Fig. 1. Machined generator rotor. Cutter (inset) cuts a Christmas-tree shaped slot (encircled on photograph).

slot in the rotor. The limited number of rotors available precluded the use of length-of-slots cut as a measure of tool life. All the tools used were still serviceable after the tests and had cut the same total length of slots. Change in tool diameter supplied the only data for statistical analysis.

The average life of production cutters in current use ranges from four to eight slot grooves. Since machining tolerances are precise, the cutter is discarded when the form cutter width decreases to the minimum slot width plus 0.002 inch. Then a new one is substituted in its place, to eliminate the possibility of the slot width being machined below the minimum dimension.

Six grades of high-speed tool steel were chosen for this program and were investigated for various reasons. Although, AISI T1 and M2 have been used for many years, the relative wearability of the two grades has been the subject of some controversy. AISI M3 and M4 tool steels were selected on the basis of supplier recommendations. Also, two free-machining (FM) grades were tested. Producers claim that FM grades are superior to standard tool steels because alloy sulfides allow for easier machining of the tool, and act as a solid lubricant during the cutting operation, thereby tending to increase tool life.

Test Results: TABLE 1 indicates the cumulative wear on each tool after each pass. The data in TABLE 1 were analyzed by the analysis of variance technique, so that the relative importance of the different sources of variation could be assessed. TABLE 2 indicates the analysis of variance.

Analysis of Variance: This statistical technique involves partitioning variability in a set of data in accordance with the manner in which it was collected. In addition to ascribing the portion of the variability to each controlled or known source of variation, it also affords a measure of uncontrolled variation or experimental error. The relative importance of the known sources of variation are obtained by comparing them with the uncontrolled or residual variation.

In certain types of experimental designs, there may exist more than one residual term, implying that certain comparisons can be more precisely evaluated than others. There are many forms of analysis of variance. The particular one used in

Nomenclature

a, b = Constants

n = Total number of observations

s = Standard deviation

t = Distribution factor

$\overline{X}$ = Average number of passes

X_i = Number of passes

$\hat{Y}$ = Predicted wear

$\hat{Y}_l$ = Lower wear limit

$\hat{Y}_u$ = Upper wear limit

Table 1—Cumulative Change in Diameter

Steel Tool Type	Tool Diameter Change (inch) Pass Number 1	2	3	4
STEEL T1				
Sample A	0.0000	0.0010	0.0015	0.0020
Sample B	0.0000	0.0010	0.0015	0.0020
STEEL M3				
Sample A	0.0005	0.0005	0.0010	0.0020
Sample B	0.0005	0.0010	0.0015	0.0025
STEEL M2FM				
Sample A	0.0010	0.0020	0.0025	0.0030
Sample B	0.0010	0.0020	0.0025	0.0030
STEEL M2				
Sample A	0.0005	0.0015	0.0025	0.0030
Sample B	0.0010	0.0015	0.0025	0.0040
STEEL M4				
Sample A	0.0005	0.0025	0.0035	0.0050
Sample B	0.0005	0.0020	0.0030	0.0040
STEEL T1FM				
Sample A	0.0010	0.0015	0.0035	0.0050
Sample B	0.0015	0.0030	0.0040	0.0050

this experiment was dictated by the manner in which the cutters were selected and the procedure by which the experiment was performed.

The number of independent comparisons that can be made for the respective sources of variation is referred to as the degrees of freedom. For certain types of factors, the degrees of freedom and corresponding sum of squares can be expressed as linear, quadratic or higher power comparisons. For qualitative variables, the particular breakdown would be in terms of meaningful comparisons in the experiment. The mean square is the ratio of the sum of squares to the corresponding degrees of freedom. An *F*-ratio, a measure of statistical significance, is obtained by comparing a particular source variation mean square with its appropriate error term or yardstick. The statistical significance is dependent on the magnitude of the *F*-ratio and also the number of degrees of freedom associated with it.

Statistical significance is related to the probability of obtaining differences as large as those observed by chance alone given that the true difference is of a particular magnitude, usually zero. Thus, in comparing two materials for a given property, it is generally realized before any data are collected, that the results for the two materials will not be exactly the same. The data are collected and one makes a decision on the basis of it, such as "buy material *A* instead of *B*." The question which may face the engineer is "is material *A* really better than material *B*, or is this just a chance event? After all, two samples of specimens of material *B* will not yield identical results."

Statistical methods offer an objective basis for making such a decision. However, it is possible to conclude that *A* is better than *B* when really there is no appreciable difference in the quality of the materials. It is also possible to conclude that *B* is as good as *A* when in truth it is inferior to *A*. These two potential types of errors face all experimenters, but they can be expressed numerically and held down to reasonable sizes that the experimenter desires and can afford. Discussion of the mathematical aspects of analysis of variance can be found in textbooks of elementary statistical analysis.

The letter *S* in the *F*-ratio column of TABLE 2 indicates that the effect noted is statistically significant. As an example, the letter *S* in the *F*-ratio column opposite Tool Steels means that if there were truly no difference in average wear among the tool steels, the probability of obtaining differences as large as those observed, by chance alone, would be less than 0.01 (1 in 100). Since the probability of being a chance event is smaller than the preassigned value of 0.01, the term "significant" is used and the differences are treated as real differences.

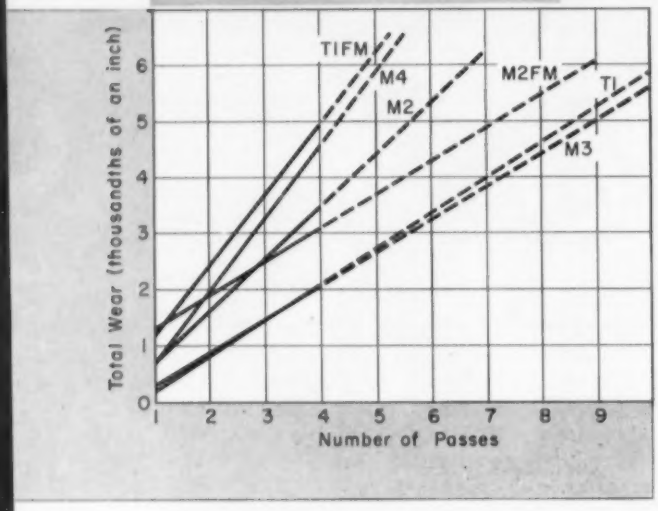
The steel-by-cut interaction, noted in TABLE 2, is also significant. This means that the rate of wear of the tool steels is not the same. This interaction term is made up of two parts; the first part reflects the comparison of rate of wear for the tool steels and the second reflects the consistency of the curvi-

Table 2—Analysis of Variance

Source of Variation	Degrees of Freedom	Sum of Squares x 10^6	Mean Square x 10^6	F - Ratio*
Tool steels (Z)	5	23.792	4.758	S
Between cutters	6	1.875	0.313	S
Cuts = (C)	3	47.792	15.931	S
C Linear	1	47.704	47.704	S
C Curvilinear	2	0.088	0.044	—
Z x C Interaction	15	6.583	0.439	S
Z x C Linear	5	5.446	1.089	S
Z x C Curvilinear	10	1.137	0.114	—
Residual	18	1.375	0.076	—
Total	47	81.417	——	—

*S Indicates that the probability of so large an F-ratio occurring by chance alone is less than 0.01 (1 in 100).

Fig. 2. (below) Total cutter diameter wear. Dashed lines are extrapolated values within 99 percent confidence limits. This chart forms the basis for determining rank of tool steels tested.



linear wear rate. The first portion was statistically significant and the second was not. On this basis, the plots of change in diameter versus number of cuts for the tools steels are straight lines with different slopes. The slopes of the various wear curves were estimated by the method of least squares and are plotted in *Fig.* 2.

Curve Fitting: The curves for total cutter diameter wear versus number of passes are fitted by the method of least squares. Least squares is a technique which minimizes the sum of squares of the distances of the data points from the fitted line. The distances are the vertical distances between the points and the line since the independent variable x is assumed to be measured without error. Although the terms "line" and "independent variable" are used, the method of least squares applies equally well to different types of curves and to several independent variables.

The fulfillment of certain reasonable assumptions about the nature of the random variation guarantees that the least squares estimates of the intercept and the slope, a and b, are unbiased and have minimum variance. That is, if a great many samples (a sample is a set of test specimens) were taken and a line were fit for each sample, the average of the fitted lines would tend to coincide with the unknown "true" line, and the variation among fitted lines would be minimal with regard to other methods of curve fitting. These two features, high accuracy and precision, make the least squares technique an appealing tool.

Samples do not yield identical data, so the estimates of the intercept and slope vary from sample to sample. Hence, one would desire an efficient method of determining limits on the fitted line so that a probability statement can be made on the "true" unknown line. These limits are referred to as "confidence limits." Confidence limits about a line are roughly hour-glass shaped. The width of a particular set of limits is dependent upon the sample size used to fit the line, the amount of variation in the data point about the line, the percentage of the confidence statement and the distance from the average value of the independent variable.

Strictly speaking, the fitted line and the associated confidence limits are valid only within the range of experimental conditions. Since a great deal of accelerated testing is presently being carried

Table 3—Predicted Wear after X Passes with 99 Percent Confidence Limits (thousandths of an inch)

AISI Grade	$X_1 = 1$ Pass			$X_1 = 4$ Passes			$X_1 = 6$ Passes		
	$\hat{Y}_1$	$\hat{Y}$	$\hat{Y}_u$	$\hat{Y}_1$	$\hat{Y}$	$\hat{Y}_u$	$\hat{Y}_1$	$\hat{Y}$	$\hat{Y}_u$
T1	0.0	0.2	0.6	1.6	2.1	2.6	2.5	3.4	4.3
T1FM	0.7	1.2	1.6	4.5	5.0	5.4	6.6	7.5	8.4
M2	0.2	0.7	1.1	3.0	3.5	3.9	4.4	5.3	6.2
M2FM	0.8	1.3	1.7	2.7	3.1	3.6	3.5	4.4	5.3
M3	0.0	0.3	0.8	1.6	2.1	2.5	2.3	3.2	4.1
M4	0.2	0.7	1.1	4.1	4.6	5.0	6.3	7.2	8.1

Table 4—Rating of Tool Steels

Tool Steel (AISI No.)	Tool Rating	Slots Cut* (No.)
M3	1	10
T1	2	10
M2FM	3	8
M2	4	6
M4	5	5
T1FM	6	4

*Probable number of slots cut before discarding tool.

out in industry and the results are extrapolated to operating conditions, some people feel that statistical methodology is some magic tool which insures the validity of extrapolation. This is not true. However, even when extrapolation is valid, it is paid for with relatively wide confidence limits.

Within 99 percent confidence intervals, predicted wear was calculated for each tool steel, as shown in TABLE 3. The equations for calculations are as follows:

Prediction Equation:

$$\hat{Y} = a + bX_i$$

Lower Limit Equation:

$$\hat{Y}_l = \hat{Y} - ts\sqrt{\frac{1}{n} + \frac{(X_i - \bar{X})^2}{\sum_{i=1}^{i} (X_i - \bar{X})^2}}$$

Upper Limit Equation:

$$\hat{Y}_u = \hat{Y} + ts\sqrt{\frac{1}{n} + \frac{(X_i - \bar{X})^2}{\sum_{i=1}^{i} (X_i - \bar{X})^2}}$$

Applying D. B. Duncan's* technique to the problem of breaking down a set of values into subsets, the six steels used form three subsets as follows:

M3	T1	M2FM	M2	M4	T1FM
2.05	2.10	3.13	3.45	4.58	4.98

The numbers below each steel are values of predicted wear in thousandths of an inch, after four passes. Any two values not underscored by the same line are significantly different and vice versa.

The probability level used for Duncan's test is 99 percent. Predicted values were used rather than observed ones because the latter were used to form the prediction equations in order to obtain better estimates. However, the largest discrepancy between the predicted value and the average observed value after four passes was only 0.0002 inch.

*D. B. Duncan, "Multiple Range and Multiple F Tests," Biometrics, 11 (1), 1955,1.

Evaluation: Although the original plan for this test program required that form cutters be used until they were scrapped, the lack of availability of rotors on which to carry out the test program caused this plan to be changed. The change, while eliminating one variable from the test program (total length of slots cut) did not seriously affect the validity of test results. The limited amount of wear allowed on the cutters (0.006-inch maximum) is well within the probable useful cutting life of the form cutter. This means that the plot of tool wear versus the number of passes, *Fig.* 2, can be extrapolated to a wear level of 0.006 inch without any appreciable danger of introducing a serious error.

On the basis of the extrapolated curve, *Fig.* 2, the tool steels used in this program can be ranked for wear resistance, as shown in TABLE 4.

The ratings of the free-machining grades are surprising. There apparently was no consistency in the wear resistance of these materials when compared with nonfree-machining counterparts. The higher rating of M2FM compared with M2 is exactly the effect predicted by tool steel suppliers. The low rating of T1FM is so far below the expected performance that some hesitation is justified before fully accepting the rating.

One possible drawback of the entire experiment was the limited amount of data available for analysis. The decrease in the number of rotors available is a disadvantage from the statistical point of view. Although the increase in validity of the data is proportional to the square root of the number of observations, it is apparent from the results of this experiment that additional data would have been of assistance, particularly in the case of results pertaining to AISI T1FM tool steel. Statistical methodology, in this case, allowed the use of the reduced amount of available data. Conclusions were drawn with less hesitation than would have been possible had the statistical analysis not been available.

Engineers and statisticians, by combining forces, can make results of experimental programs more lucid and useful. The engineer has the responsibility of deciding the over-all scope of a program with regard to what materials should be evaluated, what conditions they should be subject to, and what types of measurements should be taken. The statistician can outline the program so that the known sources of variation are evaluated and use the technique of randomization to minimize the chance of extraneous sources of variation biasing end results. Thus, the objectives of the experiment can be realized in an efficient and clear-cut manner. At the conclusion of an experiment, data can be analyzed and the results presented in terms of probability statements. The engineer then superimposes his knowledge of economic and technological aspects to present a well-rounded analysis to management.

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

High-Production Drilling Fixture

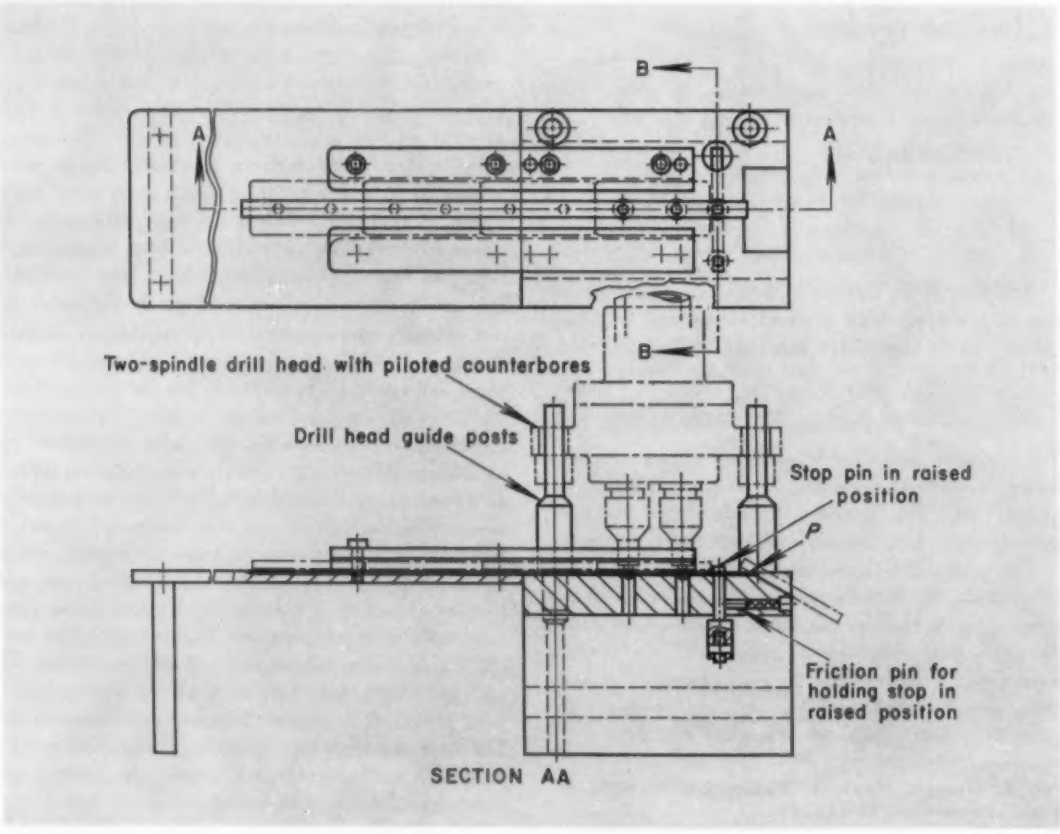
Designed to hold the part shown while counterboring two pierced holes, the fixture shown in the sketch has given outstanding performance. As the yearly requirements are quite high, a lightweight drill head was made up to be used in conjunction with the fixture. The counterbores are equipped with pilots. A stop incorporated in the fixture, together with a short spindle stroke, makes it possible to obtain a high hourly production rate.

In operation a part is fed against the stop pin, which is in the raised position when the spindle is at top of its stroke. On the downstroke the stop is pushed out of the way so the counterbored part can be ejected from the fixture and a new part fed into position. The stop pin is held in the raised position by a spring friction pin.

Return stroke of the spindle, feeding the new part against the stop and ejecting the finished part, is in two steps. After the spindle is raised enough for the pilots to clear, the part is pushed forward far enough so that it will slide down the inclined surface when its midpoint is at point *P*. The end of the new part coming into position will still be some distance away from the stop pin position when the finished part has started to slide down the incline. Bringing the spindle all the way to the top of its stroke restores the stop to its upper position and the part is fed against it.

After the operator has run enough parts to become familiar with the operation, the return stroke of the spindle and feeding and ejecting the parts becomes practically one continuous motion.

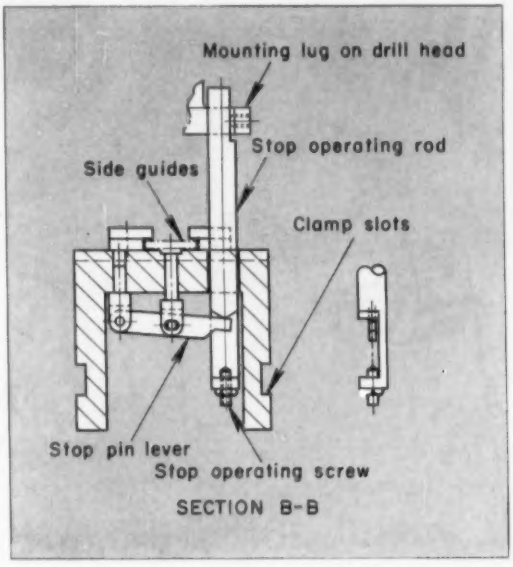
Upper travel of the spindle is limited by a stop and there is also a stop to control the depth of



counterbore. A stop operating screw is adjusted to contact the stop pin lever when the shoulder of the stop pin is against the fixture with the spindle at the top of its stroke. This rod is adjustable in the drill head and is set to bring the stop pin slightly below the top of the fixture when the spindle is at the bottom of its stroke.

The stop pin is located so that the pilots will pull the part away from the pin and the side guides are spaced so they clear the part when the pilots are entered. A support plate extends to the left far enough so that a quantity of parts can be placed on it and then fed through the guides. It is provided with a support near its outer end.

F. Murray, Chicago, Ill.



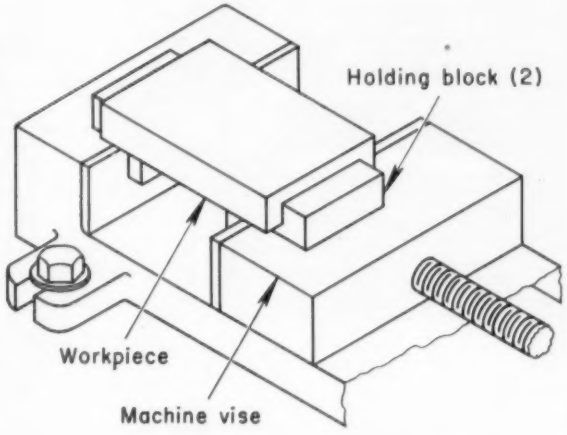
Accessory Vise Jaws

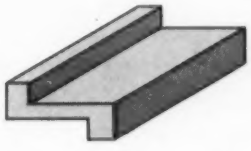
When milling or shaping the surfaces of die blocks and similar workpieces, the work is usually reset for machining each surface. This is time consuming and, unless done carefully, may result in inaccuracy.

The blocks illustrated make it possible to mill or plane three surfaces of a workpiece with one work setting. In use, the work is set up as shown and the top and two edges are machined. Then the work is turned over and rotated 90 degrees for machining the other surfaces.

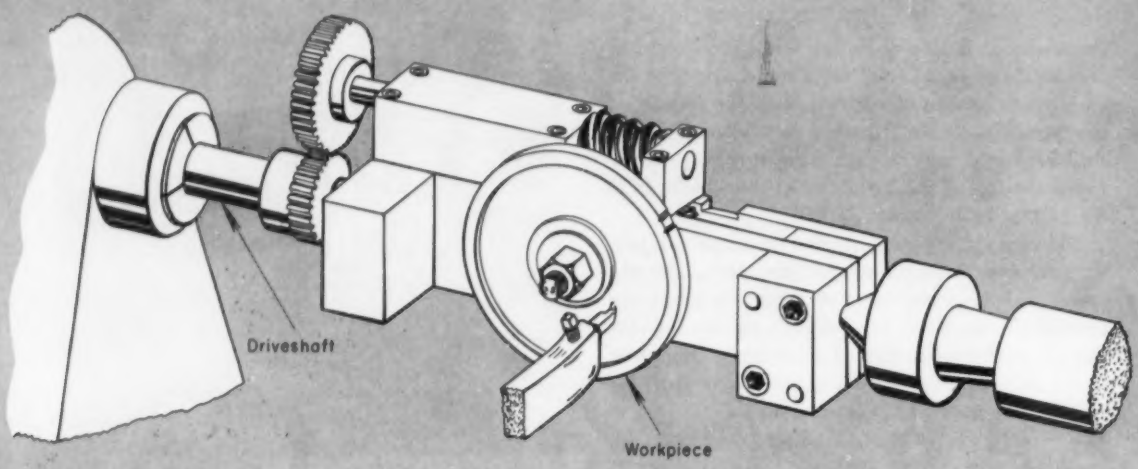
Ordinarily, different tool settings must be used for machining the top and sides. Changing the tool setting, however, is usually much simpler than resetting the work. The blocks can be made up in several sizes to accommodate a range of workpiece sizes. An added advantage is that the blocks increase the capacity of the vise.

Ernest Jones
Bronx, N. Y.

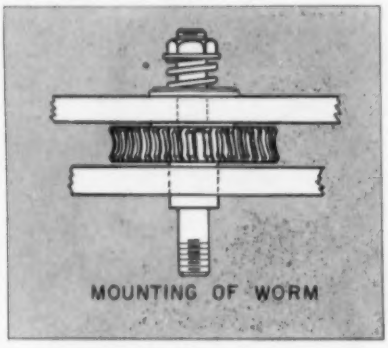




ACCESSORY HOLDING BLOCK



KNURLING FIXTURE



MOUNTING OF WORM

Knurling Fixture

Requirements for a precision instrument component called for straight knurling. Clean-cut surfaces, completely free from burrs were specified. Ordinary knurling would not give the desired result, so it was decided to machine the knurl by cutting. The fixture illustrated gave excellent results.

As shown, the fixture is designed to be mounted in a lathe. A drive shaft rotates the entire fixture and also rotates the workpiece through a system of gears. The final gear in the train is a worm mounted on the shaft that carries the workpiece (inset).

In operation, the edge of the work contacts the cutting tool with each one-half turn of the fixture. At each pass, a chip is produced. When the part has completed one revolution, the tool is fed in deeper and the operation is continued until the correct depth is reached.

Parts with various diameters can be handled on this fixture, but all sizes will have the same number of teeth. To change the pitch of the knurl, different sets of gears can be used for the sun gear and planetary gears that transmit motion to the worm gear and worm.

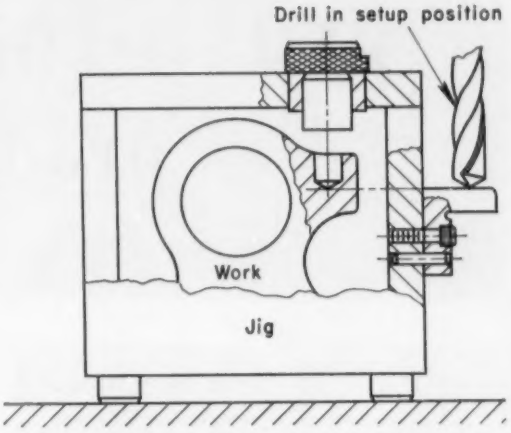
Clint McLaughlin
Rockaway Beach, N. Y.

Contributions for these pages describing short cuts for the tool engineer are welcome. Finished drawings are not necessary. Honorariums for accepted articles are sent upon publication.

Depth Setting Block

When making the initial setup on a drilling job, a set block attached to an outside surface of the drill jig is a great convenience to the operator. As shown in the illustration, the set block is an L-shaped piece attached to the side of the jig by socket screws and dowel pins. It should be made of tool steel, hardened and ground on all important surfaces. The top surface of the set block is positioned on the same horizontal plane as the bottom of the desired hole in the workpiece. Thus the operator can quickly set the spindle stop on the drill press.

H. J. Gerber
Member-at-Large



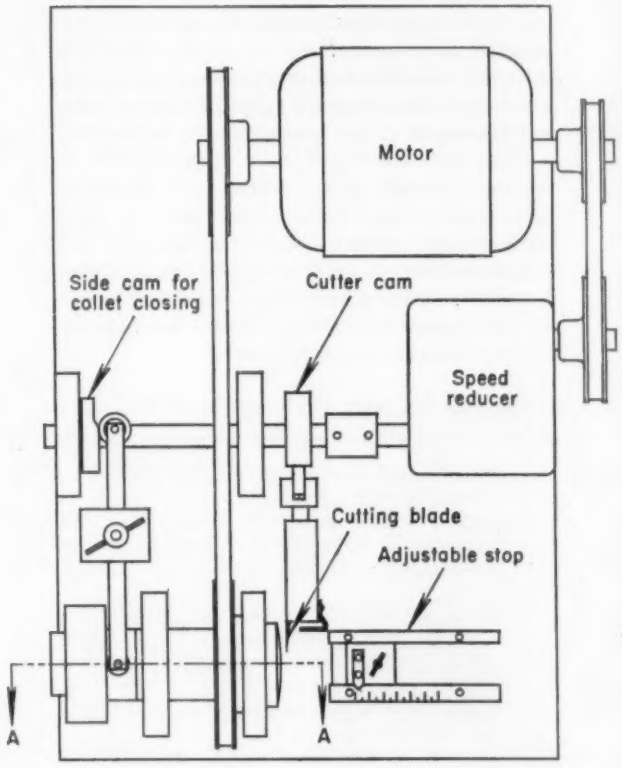
Plastic Cutoff Machine

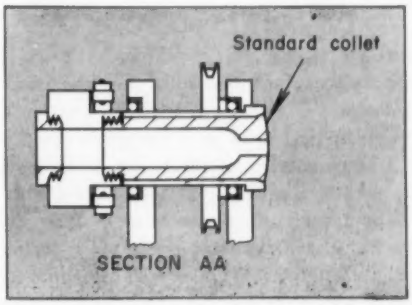
Plastic sleeving is cut off at high speeds in the improvised machine illustrated. The sleeving comes in 18-inch lengths, in diameters from 3/16 to 1 inch. Production lots are from 100 to 5000 pieces.

Tubing is inserted through a revolving collet, butting against an adjustable stop. Both the collet closing mechanism and the cutter infeed are activated by cam action. As the cutting tool retracts, the collet is automatically opened and the operator again feeds the sleeving to the adjustable stop.

This cycle is repeated at the rate of 60 cuts per minute until the sleeve length is too short to be pushed into the spindle hole. The next piece of sleeving is then used to push the remainder of the first piece of sleeving through the collet. This machine has made it possible to make frequent changes of diameters and lengths in minimum time.

Einar Hedquist
Mountain View, Calif.





crush-form grinding saves production time

By H. Bert DiPaul*

Training Coordinator
Standard Pressed Steel Co.
Jenkintown, Pa.

Crush-form grinding has been successfully applied to surface, cylindrical, centerless and thread grinding operations. The author shows step-by-step how it is accomplished and gives pointers for obtaining best results.

CRUSH-FORM GRINDING is an accurate and rapid method of producing duplicate pieces by transferring the form or shape of a preformed crush roll first to the face of the grinding wheel and then to the work, *Fig.* 1. Three basic steps are involved, *Fig.* 2: making the crush roll, shaping the face of the wheel and grinding the workpiece.

The profile desired on the workpiece is first ground or machined onto the surface of a metal roll, *Fig.* 3. The reverse form of the shape of the roll is then transferred to the face of the grinding wheel by crush truing. The final workpiece profile is applied by grinding.

Making Crush Rolls: High-speed (18-4-1) steel is generally used for crush rolls. For short runs or experimental jobs, however, the rolls can be made of free-machining steel or close-grain cast iron. When a large number of pieces are to be ground, several work rolls and one or more master rolls are made. The master roll is used to form the grinding wheel with which duplicate crush rolls are made, *Fig.* 4. The number of master rolls which are to be made depends on the number of pieces required and the number of crush rolls to be made. A slight loss of accuracy in the convolutions on the roll is sustained at each use. Hence, dimensional tolerances will dictate to a large degree the number of master rolls.

The smallest diameter roll practical should be used in order to reduce to a minimum the area of contact between the wheel and the roll. This contact area has a marked influence on the amount of pressure that must be applied to the crush roll to form the wheel face. Greater contact area requires greater pressure. Rolls generally range from three inches to six inches in diameter and up to 9½ inches wide.

Crush rolls are shaped to an exact duplicate of the shape desired in the work except for helical grooves and threads. They should have an accurately ground bore to fit the shaft of the crush form dresser and an accurate locating face ground square to the bore. Other tolerances vary according to production requirements. Thread form rolls are usually held to tolerances of ± 0.0002 inch.

Shaping Wheels: Operators should keep these points in mind when crush forming a wheel:

1. Bring the wheel and roll in contact gently by hand while both are at rest
2. Preload by bringing the wheel down 0.002 to 0.004 inch more to create enough pressure for forming action and to prevent slippage which puts a flat spot on the roll
3. Follow the wheel into the form fast enough to prevent slippage and slowly enough to avoid overloading (about 0.0002 inch per revolution). The applied crushing force ranges from 100 to 500 pounds per square inch of wheel face depending on wheel grade and depth of form
4. Keep the grinding wheel rotating slowly (100-300 fpm)
5. Don't let the wheel roll free at the end of the cycle.

*Senior member ASTE Philadelphia chapter.

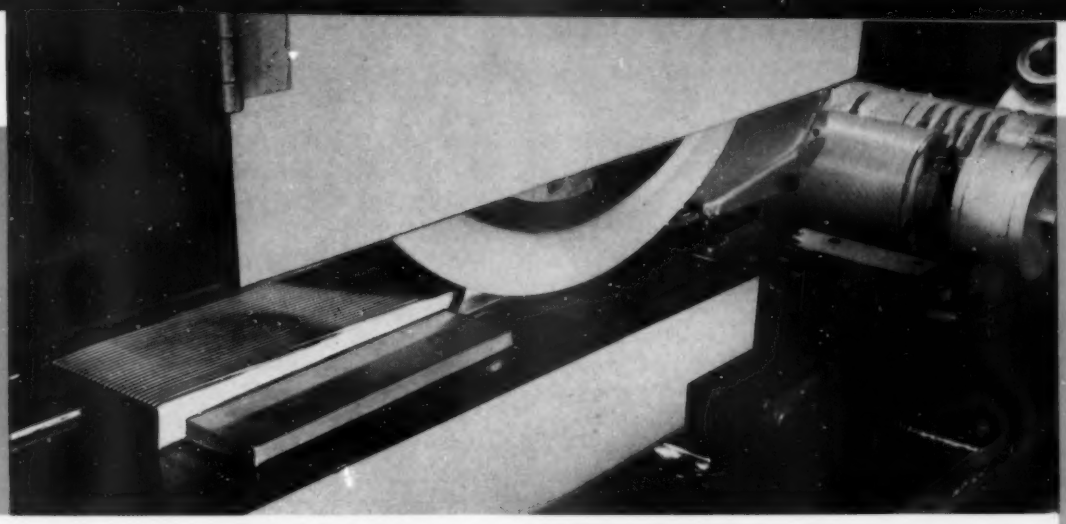
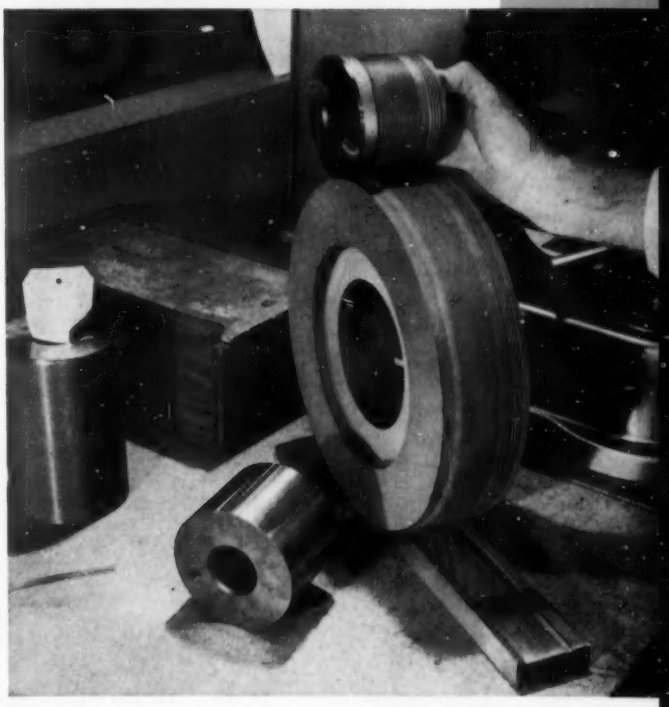


Fig. 1. (above) Wheel formed by crush roll is used to grind close tolerance shape on thread roll die.

Fig. 2. (right) Crush roll (top) transfers the form to the grinding wheel which is used to produce thread roll at bottom.



After the crushing operation is finished, leave the wheel in contact for three or four revolutions then back it out.

Grinding Workpieces: There are two accepted ways of using a wheel which has been crush trued or formed. One involves feeding down by small increments on each pass. The other method is to bring the wheel down to the level of the full cut and make a single pass across the work. This method requires the use of a slow-feed crush-grinding table which moves at a rate of about one ipm for feeding the work into the wheel and returns at a rapid rate.

Wheel Selection: When ordering wheels for crush grinding, the requisition or purchase order should specifically state that they are to be used for this purpose. Grinding wheel manufacturers have special dimensional and balance tolerances for such wheels. Only vitrified bonded wheels are used for

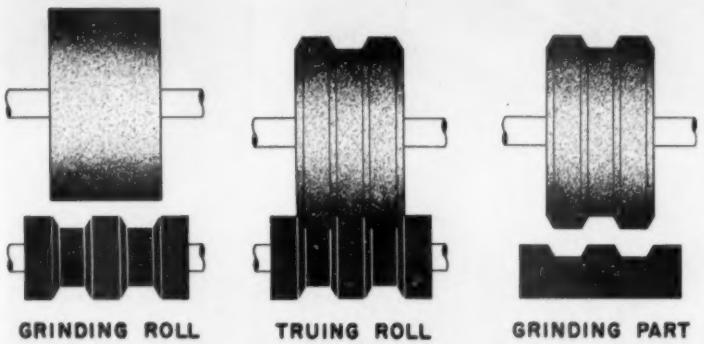


Fig. 3. Profile of workpiece is ground on crush roll. Roll is used to true grinding wheel. Final form is accurately produced on workpiece.

crush forming. Organic bonded wheels are too resilient for such use. Both aluminum oxide and silicon carbide wheels can be crush formed. Grit size is determined by the use and finish required. Generally, finer grit and harder grade wheels are used for crush grinding than for conventional grinding.

The accompanying table shows the coarsest grit sizes recommended for grinding various radii and different pitches of thread. Softer wheel grades should be specified for work that is to be ground in one pass with full depth of cut than for traverse grinding with lighter feeds. The material being ground, particularly its hardness and the amount of surface area in contact with the wheel, should be considered. Harder steels require softer grade wheels to avoid burning the work. An interrupted contact when grinding requires a harder grade grinding wheel than continuous contact.

Coolants and Equipment: For grinding and crushing, straight grinding oils, rather than soluble oils, give the most satisfactory results. Less pressure is required and wear on crusher rolls is reduced when straight oil is used during crushing. In thread cutting, where an exceptionally sharp form is required, straight grinding oil contributes to freer and cooler cutting. Consequently, harder grade wheels that stand up longer between crushings can be used.

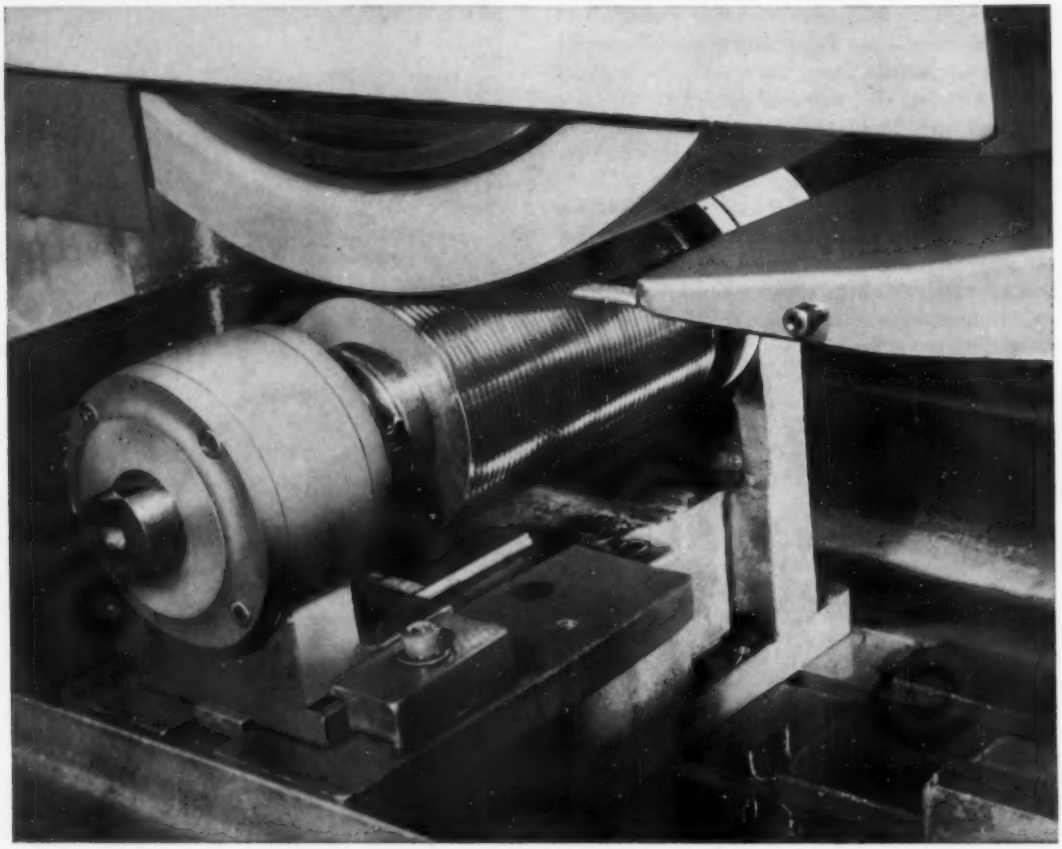
The high stresses involved in crush truing make it necessary to use extremely rigid equipment. Grinding wheel spindles must be heavy duty and of rugged construction. Crush rolls must be securely mounted in heavy fixtures. It is unsafe to use wheels with lead or babbitt metal bushings as these bushings may squeeze out under the pressure of crush truing. It is also recommended that grinding wheels be removed from spindles with the adapters attached so as not to disturb balance. When all of these precautions are observed, crush-grinding operations are safe, fast and accurate.

Grit Sizes for Grinding Radii and Threads

Maximum Radius for Form Grinding (inch)	Threads per Inch for Thread Grinding	Coarsest Grit Size
0.003 to 0.004	24 to 32	320
0.005 to 0.007	16 to 24	220
0.008 to 0.011	11 to 14	150
0.012 to 0.020	5 to 10	120

Courtesy Norton Co.

Fig. 4. For high production operations where more than one roll is needed, pattern from master crush roll is transferred to grinding wheel. Wheel is then used to make other crush rolls.



overload clutch

designed for accurate torque control

By Bernard R. Better*
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Clutches for power transmission as well as equipment protection present many difficult development problems. Requirements, characteristics and final design of such a unit are outlined.

ECONOMICAL AND EFFICIENT torque transmission coupled with protection of both the driving and driven members requires an overload clutch with a high degree of dependability. It must function with unimpaired efficiency at high speeds and in relatively high ambient temperatures. Also, it should not be affected by conditions of moisture or other adverse conditions. In applications like high-speed tapping, the overload release in a clutch is a built-in safety feature to prevent breakage of taps should excessive torque be applied. Similar requirements are found in many fields using power equipment, *Fig.* 1.

Early attempts to develop practical clutches using conventional elements produced poor results. Many of the devices tried depend on the slippage of frictional material or metal against metal under pressure, thus, they introduce the variable coefficient of sliding friction. The result is that torque required to cause slippage becomes erratic. In some installations, a fairly wide deviation from torque limits may be permissible—but a tapping operation does not permit loose torque control to exist.

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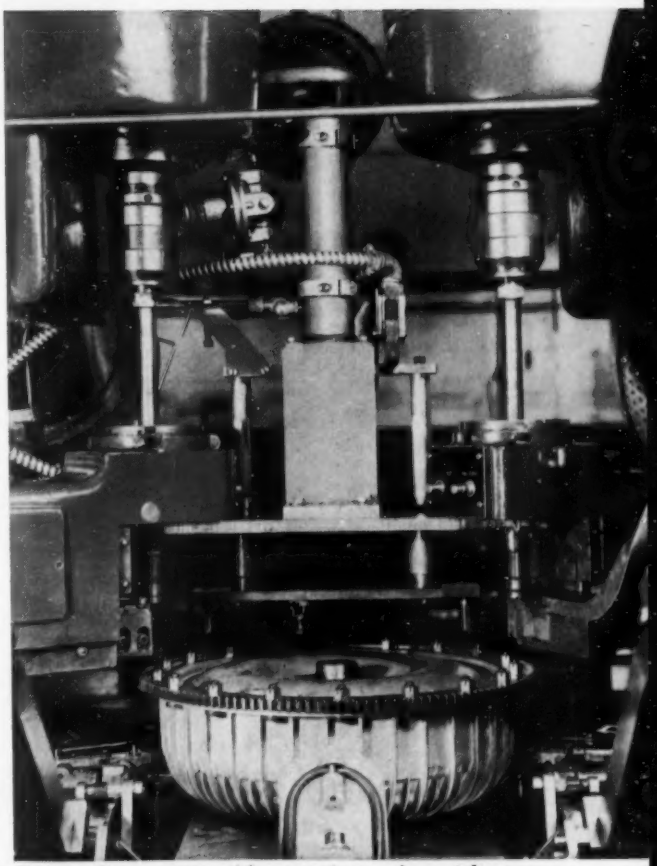


Fig. 1. Nut runners with extension sockets tighten nuts on a transmission housing in a special assembly machine. The overload clutches are mounted near the motor housing to reduce the length of the drive-shaft input, preventing distortion in this shaft.

Basically, a mechanical overload clutch for this job should have the following characteristics:

1. No sliding members for transmitting torque
2. High torque capacity for its size
3. Adjustability in fine increments over a wide torque range, plus the ability to maintain this adjustment over a long operating period
4. Precise release at predetermined torque, free-wheeling operation when released, and ready reset to driving position
5. Operation with either clockwise or counterclockwise rotation
6. Simplicity and adaptability to many applications

Reviewing these requirements make it evident that the problems posed are difficult ones. Actually, some of the factors seem to work against each other. Yet, even a preliminary survey of potential requirements showed that any device with real usefulness had to solve all of them.

The basic clutch developed to provide these features consists of the torque transmitting elements, a torque adjusting method, a device for putting the clutch in a free-wheeling position and a reset method to put the clutch into driving engagement. This clutch is named a "Safe-Torque" clutch and its features are illustrated in the drawing in *Fig.* 2. The method of re-engagement of the clutch varies with the application. Re-engagement can result from reversing the direction of shaft rotation, axial movement either up or down or a variety of other means.

To transmit torque, the shell body of the clutch has a tapered bore, heat treated to approximately the same specifications as roller and ball bearings. Inside this shell is a cam with a taper corresponding to that of the shell as shown in *Fig.* 2. Six equally spaced lobes make up the actual driving surfaces. Rollers are interposed between the cam and taper bore of the shell and are held in place by a cage. As the shell is driven, the rollers are wedged between the incline of the cam surfaces and the cylindrical tapered bore of the shell, *Fig.* 3. As torque increases, the rollers climb higher on the cams and are wedged between the cam surface and the tapered surface.

This wedging force creates elastic deformation of all the parts during the transmission of torque. When the manually preset torque is exceeded, the rollers override the high points on the inner cam drive and roll into a free position. No further torque is transmitted and the driven member immediately becomes free wheeling, *Fig.* 3. It stays in this position until the clutch is reset.

Some of the variables that must be considered in designing clutches of this type are the fatigue life of parts in relation to the size, torque, rate of cycling, diameter and length of the part. If, for example, the clutch is not to be cycled too often, permissible stresses can be higher and smaller physical dimensions may be used. Tools that require the clutch to withstand millions of cycles require designs with lower stresses on the elements.

Clutches for torque applications are designed with a life expectancy similar to that of heavily loaded

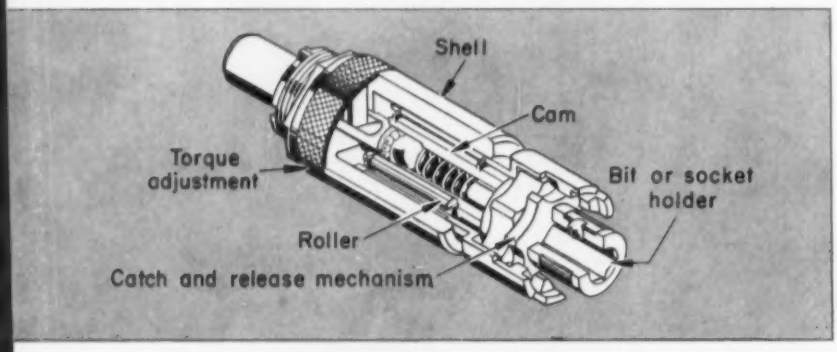
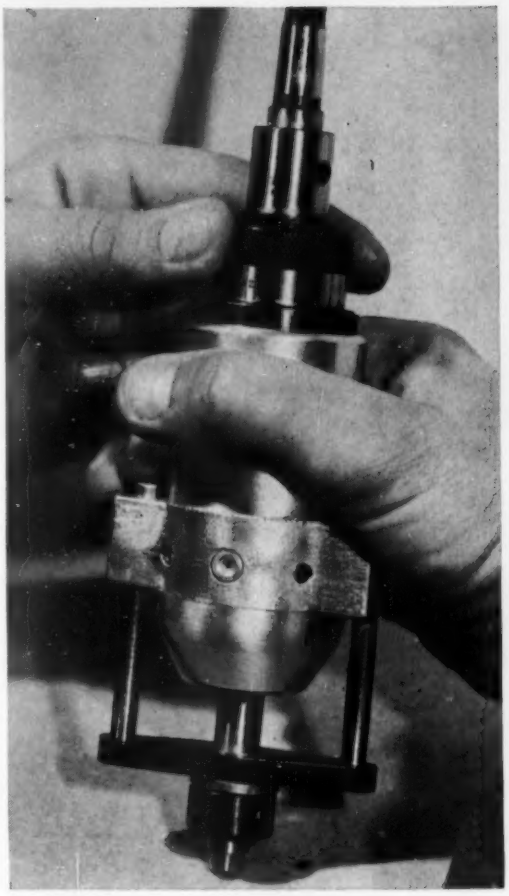


Fig. 2. (left) Cutaway of a clutch showing its major components.

Fig. 3. (below) Operating positions of the clutch. During drive, rollers climb the cam surfaces when pressure is exerted on the output to wedge between shell and cam transmitting the torque. Free wheeling occurs when driving parts are deformed and ride over high points on the cam. The ready to drive position is reached when pressure is removed from the output side of the clutch, release and catch to move the rollers to start position for the next cycle.

Fig. 4. Adjustment of torque is made by moving the tapered inner cam in or out of the taper in the shell body, thus varying clearance by moving the knurled adjusting nut to the desired position.



antifriction bearings. Enough operating data has been accumulated to certify the life of such parts within the prescribed limits.

As the cam and shell are moved axially in relation to each other, *Fig.* 4, it is possible to vary the amount of interference which the rollers sustain when being wedged through the spaces between these two members. This interference can be used to determine the limits on the amount of torque that can be transmitted before the rollers ride over the high points of the cams.

One of the advantages of this design is that it can be adjusted in stepless increments. Range of torque adjustments can be varied from zero to the maximum capacity of the clutch. A plot of the torque against the adjustment (which is the axial shift of the cam in relation to the shell) develops a smooth curve, with a small rate of increase at the settings near zero torque and an almost straight-line relationship at higher torque settings.

When driving a tap, the clutch releases if the tap meets excessive resistance due to hard spots, tap dullness, or other causes on its forward cut. Reversing of the spindle to extract the tap resets the tool for the next cycle. Clutches for fastener tools usually are reset by pushing the driving tool down on the fastener. After the fastener is tightened to the preset torque, the clutch overrides and goes into free wheeling. Lifting the tool off the fastener puts the clutch into a position for the next work cycle.

On fastening operations, the equipment assembly job is done better because fasteners can be tightened to the optimum amount without concern about damage to work or fastener. Equally important are operations that require driving threaded fasteners into soft materials like aluminum or plastics.

Similar clutches are being used on radial drills, drill presses, boring mills, and transfer machines. Because operators are relieved of the worry of tool breakage, work can be performed much closer to the rated capacity of the machine or tool.

Brazing Technique Chops Operation Time

Attention to the induction heating setup allows components of such metals as titanium and stainless steels to be high-temperature brazed in minutes instead of hours. Furnaces with controlled or inert atmosphere facilities are commonly used to do comparable work. However, metals like titanium can be readily contaminated by gases in air even where temperatures above 1000 F are rapidly or only temporarily produced.

To avoid contamination, National Heat Treat Co., Inc. seals off temporarily assembled parts and brazing alloys in Pyrex retorts; air is evacuated so the components can be shielded at elevated temperatures by argon. Portability of the retorts permits sealing and readying for use in advance of heating. Consequently, the company realizes a higher production rate from the induction machine where brazed joints require inert gas protection.

Currently, National is using a silver-lithium brazing alloy in assembly of parts at temperatures above 1000 F. Following use of induction heat, parts are given ample time to cool before they are removed from the inert atmospheres of their retorts. Resulting work has a bright scale-free luster. Destructive physical test shows that materials brazed by this method usually fail outside of joined areas at levels high enough to indicate no deterioration of the properties of the parent metals.

improved Threading Techniques ...simplify production

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Newer threading methods produce high-quality threads for instruments and other precision units. Advantages of the processes, examples of successful applications and the resultant savings are outlined by the authors.

INDUSTRY'S EMPHASIS on miniaturization has led engineers to investigate better methods of threaded fastening. Two techniques which produce high-quality small threads internally are thread rolling and tapping with short flute taps.

Thread rolling is a cold forging process which displaces metal by compression. Because the fibers of the material are not cut in the process, a strong thread, *Fig.* 1, is obtained with a refined grain structure in the compressed material. The threads have few surface blemishes to affect fatigue strength.

Major differences between processing internally and externally rolled threads involve the relative strengths of the tools and the tolerances of the part being threaded. A tap does not have the strength of a die due to the very nature of its construction.

A hole size larger than that for conventional tapping is required because of the material flow, just as a smaller diameter is required for rolling external threads. Generally, holes need only be drilled—except where the percentage of thread height must be held to close tolerances. In this case, the hole should be reamed to a tolerance of ± 0.0005 inch to avoid increased tap breakage.

As a result of the diameter tolerances, the thread will have a concave crest, *Fig.* 2, which gives the appearance of a double thread. A comparison between cut and rolled threads is shown in *Fig.* 3.

Tap Design: Hardened screws were the first tools used for internal thread rolling. Major problems developed in their use because of the close fits and high bending loads which increased the power requirements of the operation. Proper lubrication of the tap during threading in blind holes presented a problem due to the hydraulic cylinder effect.

As a result, taps, developed for this process, have pitch diameter and major diameter relief. These changes reduce the torque requirements of the operation and permit the use of cutting fluids for the difficult blind-hole tapping.

Materials: Good results have been obtained when rolling threads in aluminum, zinc and brass. However, most of the savings have been made when tapping electrical steel parts. The problems of long, stringy chips and excessive tap breakage have been eliminated even when tapping threads as small as 4-40 UNC and 6-32 UNC.

Cutting Fluids: Special cutting fluids are not required. The same fluids that are used with conventional taps can be used for thread rolling taps.

Cost Savings: Thread rolling of blind holes has produced significant savings. Operations to remove chips have been eliminated, more holes are threaded per tap, added operations (usually required to tap

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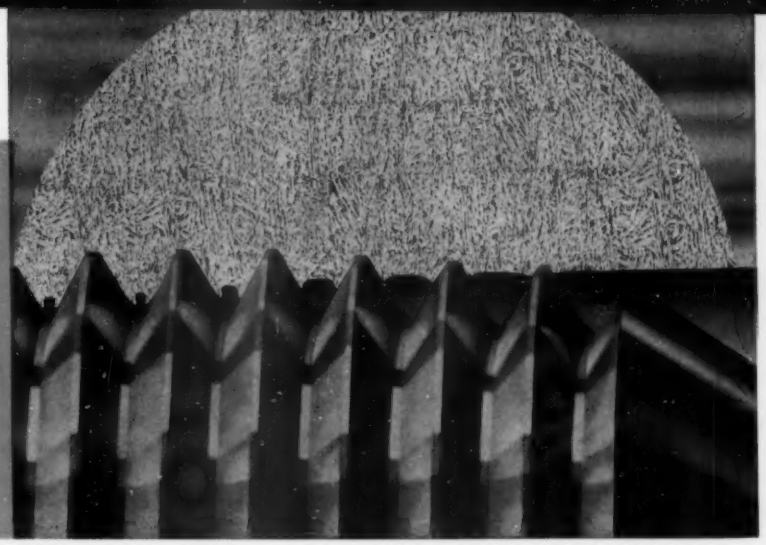


Fig. 1. Cross section of a part being threaded. Lead threads are shown at right. Thread rolling produces no chips at the bottom of the hole, a major problem in cut threads.
—Photo courtesy Besly-Welles Corp.

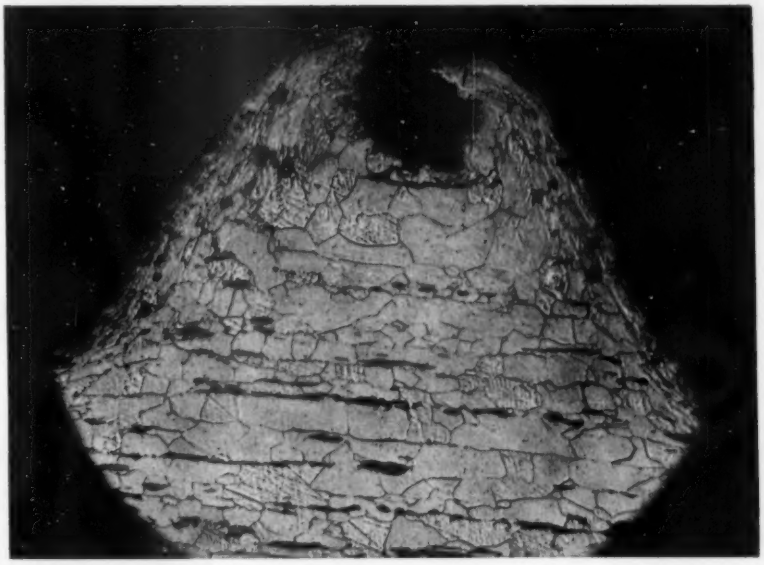


Fig. 2. Photomicrograph of a rolled thread in a leaded steel part. The upset grain pattern on the thread flank illustrates the effect of cold working on the surface and top of the thread. A stronger thread is obtained with fewer surface defects and smoother flanks to make subsequent assembly operations easier with fewer rejections for defective threads.

to full depth on deep blind holes) have been eliminated, and machine down time and scrap have been reduced. On a brass terminal part, excessive tap breakage, as a result of packed chips, was eliminated. Prior to the introduction of this tool, two-fluted taps were used and averaged about 900 holes. Using the thread rolling tool on the similar operation, production exceeded 70,000 holes per tool.

This method of producing threaded holes has proved its value on tapping blind holes, expensive castings and the difficult materials used for electrical components. However, thread rolling has not been found economical for through holes in sheet metal parts less than one-eighth inch thick. The less expensive short-flute tap is satisfactory for these parts.

Short-flute taps have eliminated excessive burr problems encountered in plated thin metal parts. They have also helped reduce threading costs in two ways. First, they are about 20 percent less expensive than standard fluted taps and, second, they thread two to three times more holes. A higher quality of thread is obtained and many special styles of taps are eliminated. Since these taps have flutes that are only about $\frac{3}{8}$ inch long, the taps are stronger in the shank and break less frequently.

Quality Improvement: A less tangible saving, but just as important, is improved quality of threads. The fluteless portion of the tap burnishes the threads, removing much of the surface roughness. High surface finish is due in part to using rolled threads on the tap rather than normal ground threads. Plating buildup on the threaded part is not as great on these thread flanks so the quality of the finished thread is improved.

In order to insure properly sized finished threads, sizes have been increased on the "before plating" gages. Since the pitch diameter of the thread is de-

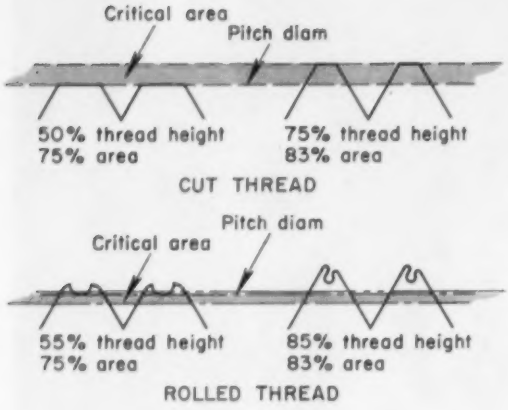


Fig. 3. Tooth forms for cut and rolled threads, showing thread shape relative to its area. The characteristic double crest of the rolled thread is evident in the comparison of thread cross sections.

creased by four times the plating thickness, a hole is tapped 0.0016 inch larger on the pitch diameter than standard for a 0.0004-inch zinc plate. This is especially important for small machine screw sizes.

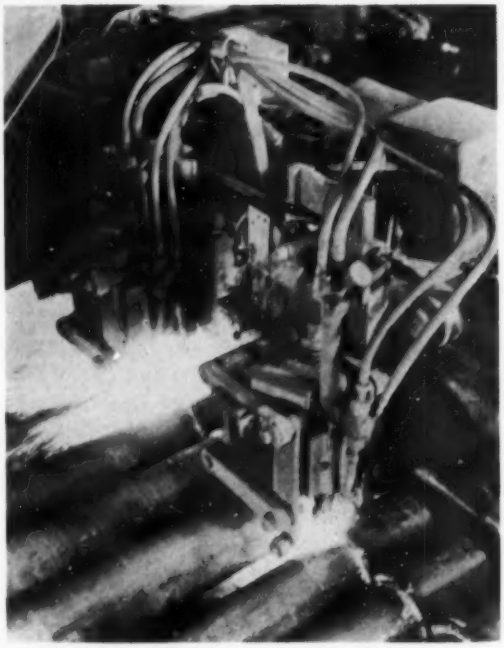
Smooth thread flanks and proper size threads are important on assembly lines using power screwdrivers. Screws gall and jam more frequently when these tools are used with rough or tight threads. Jamming of screws is expensive because assembly lines are slowed down and rebuilding of parts is generally costly. Since using the new thread standards and taps. quality has been improved and threading repair costs have been reduced. A good illustration of this quality improvement is a scale plate on one of the furnace limit controls. Three lots of parts were rejected in six months due to tight threads on two UNC 3-48 holes. The parts are zinc plated to prevent rust. Even with acceptable lots, the zinc-plated screw would jam under the pressure of a power screwdriver and the instrument would be set aside for repair. The cost of retapping and rebuilding on this part alone was estimated at $250 per year. Since changing to the rolled threads, threading costs were reduced $200 and savings in rebuilding costs were $250 for a total savings of $450. In addition, the former cost of retapping rejected lots of these parts was eliminated.

Powder Metal Gives a Push to Flame Cutting

A BOOST IN OUTPUT and a slash in production costs were acquired when Pittsburgh Steel Co. introduced flame cutting to its operation. The job at hand is slicing billets 3½ to 7½ inches in diameter into lengths from 4 to 12 feet. Materials involved range from mild steel through high carbon to 4 to 6 percent chrome alloy. To enhance efficiency of the machine, a special iron powder is added to the oxygen to produce an intense reaction and get the cuts on the round surfaces cutting flame off quickly.

By replacing the shears that previously had been used for this work with powder cutting, each eight-hour shift is turning out more than 1000 billets. Engineers of Linde Co. cooperated with Pittsburgh Steel in designing and construction of the automatic machine. Two cutting torches with power cutting attachments are mounted on the machine carriage that automatically controls the cutting speed. Cams ride on the surface of the billets and raise and lower the torches to follow the round surface. The iron powder is fed into the cutting oxygen stream from a pneumatic powder dispenser. This also allows the operator to pick up the cut quickly if the machine should be stopped at any point in its cycle.

Experience has shown that the powder cutting prevents elliptically shaped ends, and does not produce cracks that show up as open seams in tubing.



Two Oxweld C-39 torches cutting quickly and squarely through several billets. The tailor-cut billets will be fed into seamless tube hot mills to be made into tubing which varies from 2⅜ to 8¼ inch OD.

REAMING

...accuracy improved with coolants

By B. L. ten Horn, Head of Development
R. A. Schuermann, Development Engineer
and J. Slaats, Staff Engineer

Machinefactory
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These reaming tests prove that the proper cutting fluid improves dimensional accuracy in addition to extending tool life. Steel, under proper conditions, has been found to machine like brass. Results of this research have been adapted to practical application by the authors.

DEMANDS FOR BETTER FINISHES and closer tolerances have necessitated refinements of our basic machining processes. Reaming is one of the processes that has often given erratic results when the fixed machine reamers are used.

Since the reamer has a fixed size, *Fig.* 1, the diameter of the finished hole is determined by the tool. The machine operator has practically no control over the results. Operating conditions that can be freely chosen, such as feed and speed, have only a minor influence on the hole size and so cannot be used as an effective control. The workpiece material has a definite influence on the results, but this variable cannot be chosen freely in most cases.

In practice, the operator resorts to a correction of the reamer with a hand hone. Many operators are skilled in the art of touching up a reamer by hand. However, a retouched reamer is unsuitable for the next job on a different material and has to be rejected or reground to a smaller size.

To obtain data on reamer operation, high-speed reamers were used to finish holes in free-machining steel and cast tin bronze. Each of these materials has different characteristics when reamed. For the tests, reamers were finished to the highest possible degree of accuracy and carefully measured.

The reamer was fixed rigidly in a stable drilling machine and accurately centered above a hole of known dimensions. Feed, speed and reaming allowance were systematically varied while holes were reamed for every set of conditions to permit statistical evaluation of the results.

These preliminary tests showed that, although the variation of conditions in the explored range did have a minor influence on the diameter and surface condition of the holes, the difference in workpiece materials was by far the most important factor. The same reamer produced holes of different sizes in different workpiece materials.

The only remedy seemed to be to use reamers with a given size correction for the workpiece material. This would be impracticable. It would involve an exceedingly large number of different reamers for each hole size, fit and workpiece material. In addition to keeping large tool stocks, the danger of errors would be tremendous.

At this stage of the investigation, it was realized that the only practical solution of the problem was to make a reamer cut in a uniform way independent of the workpiece material. This may seem to be an ambitious goal but the preliminary tests afforded a clue that such control was possible.

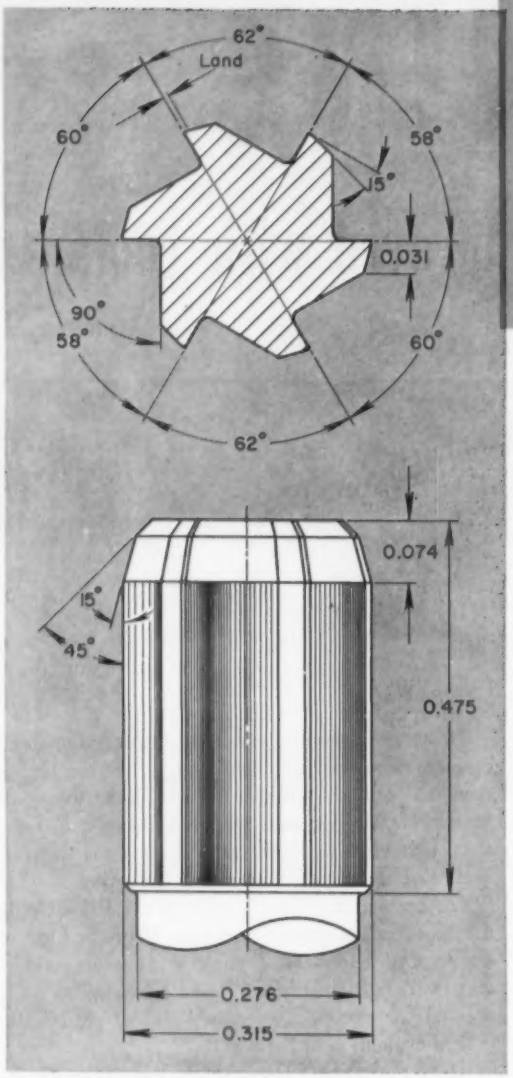


Fig. 1. Geometry of carbide reamers used in tests.

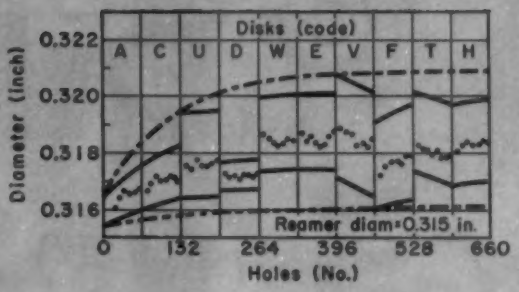


Fig. 2. Results of reaming tests in free-cutting steel with high-speed steel reamers. The cutting fluid was mineral oil. Dots indicate the arithmetic mean of 32 diameters measured in eight holes.

Effect of Materials: These tests disclosed two well-defined conduct patterns of the workpiece material in relation to reaming. The discovery of these two types of behavior was not accidental as the workpiece materials, steel and bronze, were deliberately chosen because of the well-known difference in their reaming behavior. The experiments did no more than produce a more precise description of facts that were fairly generally known.

On the basis of the experiments, the reaming results can be described as follows:

Bronze: Reamer cuts a hole slightly undersize in relation to the reamer diameter. Successive holes become somewhat smaller as wear develops on the reamer. This wear can be minimized either by nitriding a steel reamer or by using carbide reamers.

The reamer diameter as measured over the cylindrical lands shows no wear. The reamer fits tightly into the holes it has produced and the fit becomes tighter as wear progresses. This condition agrees with the decreasing hole size and the constant reamer size. The hole size is consistent and its surface is good if allowance is made for a relatively small number of well-defined scratches.

Steel: Reamer produces oversize holes in relation to its measured diameter and fits loosely into its own holes. Hole size is much less consistent than in the case of bronze and tends to increase rather than decrease as wear develops on the reamer. Surface roughness is high and the roughness is general rather than concentrated in local defects.

Effect of Built-up Edge: The facts established by the preliminary tests and summarized in the behavior patterns can be explained by assuming that a built-up edge is present in the case of steel and absent, or nearly absent, in the case of bronze.

When reaming without the presence of a built-up edge, the hole is cut by the real cutting edges of the reamer. Thus, there is no reason why oversized holes should be produced when the reamer is accurately ground and accurately centered above the hole. The workpiece material in the region of the cutting edges is pushed back slightly by the action of the cutting forces, and an undersized hole may be expected. As the cutting edges become dulled, cutting forces increase and hole size decreases accordingly. The fact that no wear can be measured on the cylindrical lands of the reamer indicates that wear is limited to a rounding off of the cutting edge.

The theory that the decreasing hole size is brought about by increasing cutting forces is in agreement with the tighter fit of a worn reamer in its own holes. Just as reamer size is faithfully reproduced in the size of the hole, the smooth cutting edges will also be reproduced in the hole.

When a built-up edge is present, the real cutting edge is protected and no rounding off takes place. No gradual decrease in hole size is to be expected. The built-up edge overhangs the real cutting edge

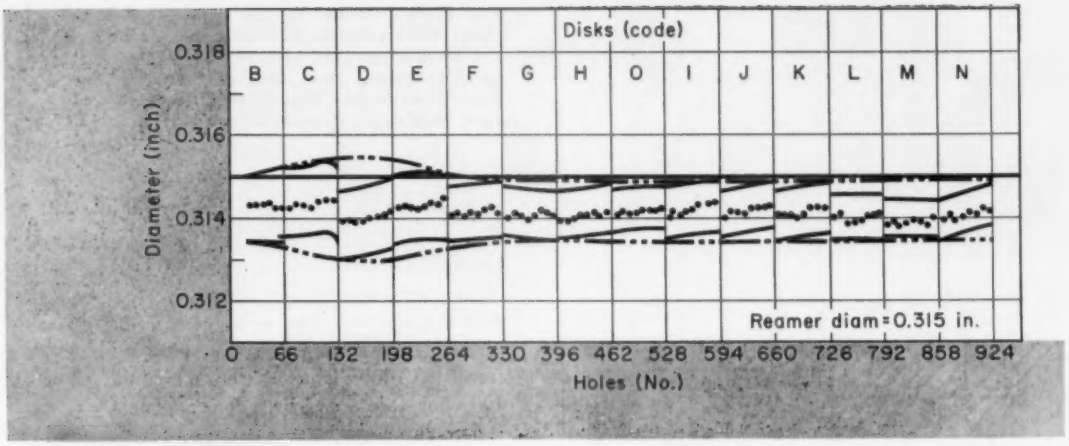


Fig. 3. (above) Carbide reamer test results in bronze workpieces. Mineral oil was used as the cutting fluid. The arithmetic mean of 32 diameters measured in eight holes is indicated by a dot.

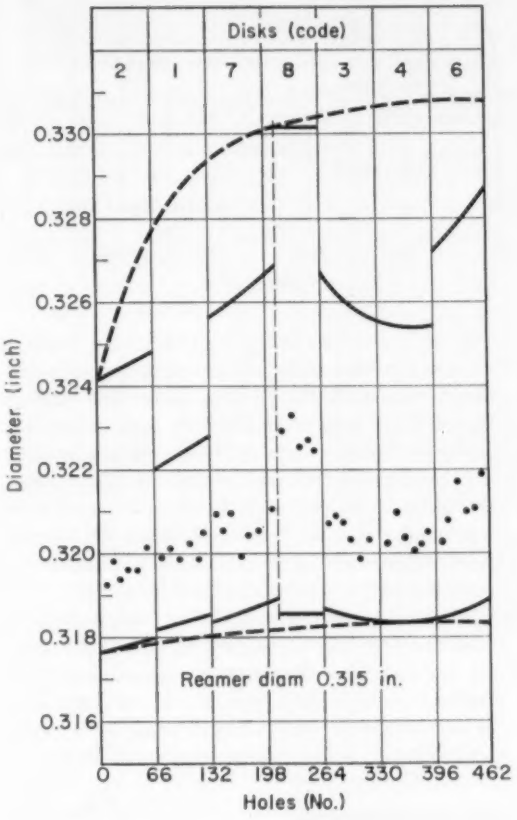


Fig. 4. (right) Plot of holes reamed with a carbide reamer in free-cutting steel, using mineral oil.

and accounts for the oversize hole.

Many investigators have reported how a built-up edge alternately grows and collapses, leaving fragments of workpiece material welded to the surface that has been generated. In addition, it is highly improbable that the alternate processes of growth and collapse of the built-up edge will take place simultaneously along the entire active length of the cutting edge and so a jagged cutting edge is to be expected. These two facts explain the bad surface condition found when reaming steel.

The fact that the oversize hole always coincides with a rough surface and undersize hole with a smooth surface suggests that both phenomena have a common cause. This common cause is believed to be the built-up edge.

If the presence of a built-up edge can change the behavior pattern described for bronze into that described for steel, the reaming problem can be solved by taking measures against the formation of a built-up edge. In the course of the experiments a few holes were reamed in free-machining steel using a soluble oil instead of the vegetable oil used in most of the other tests. The amount of oversize in the holes decreased sharply and surface condition improved with the change of cutting fluid.

Effect of Cutting Fluids: The fundamental role of the built-up edge based on normal metal-cutting theory indicates that the built-up edge can be influenced by an appropriate choice of cutting conditions. To eliminate a built-up edge requires:

1. A radical increase of the cutting speed well into the carbide speed range. This method is seldom applicable to reaming because extremely high spindle speeds would be necessary for the current reamer diameters.
2. The use of cutting fluids that provide real lubrication on the chip-tool interface. To produce this lubrication, the cutting fluid must be chemically active and highly penetrating in nature. In addition, the cutting speed must not surpass a certain value given by Shaw[1] as 40 fpm. At higher cutting speeds the speed of penetration of the cutting fluid is insufficient and becomes ineffective.

[1]References are tabulated at end of article.

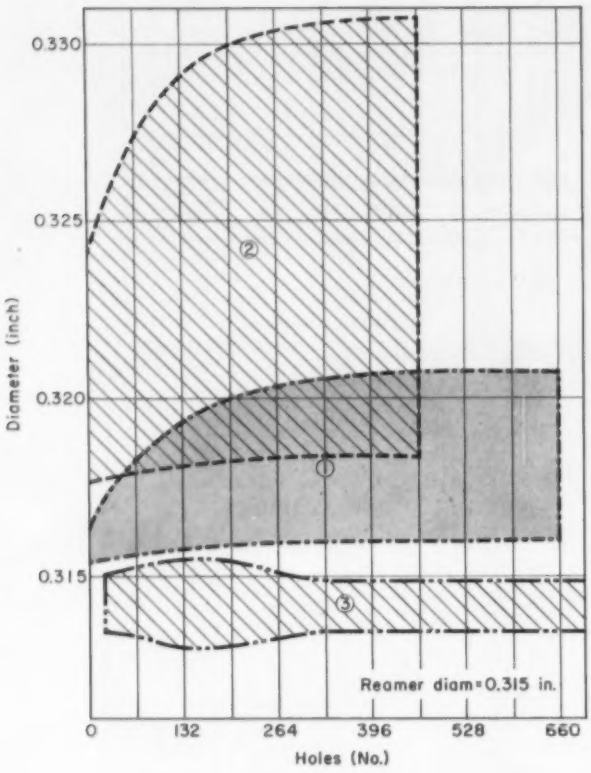


Fig. 5. Comparison of the diameter deviations for three different tests. In Test 1, free-cutting steel was cut by a high-speed reamer; Test 2 was performed on free-cutting steel with a carbide reamer; and Test 3 was run on bronze with a carbide reamer. All tests used mineral oil as the cutting fluid.

In view of this cutting fluid theory, a reaming test was run on a piece of free-machining steel submerged in trichloroethylene using low cutting speeds. The results were spectacular and convincing. In the preliminary tests the hole sizes produced in steel averaged 0.001 inch above the reamer size. The holes in bronze were from 0.0002 to 0.0004 inch smaller than the reamer diameter. Representative roughness figures were 25 to 30 microinch rms for steel and 3 to 4 microinch rms for bronze.

When using trichloroethylene on steel, holes were 0.0001 to 0.0002 inch smaller than the reamer diameter and roughness figures were reduced from 2 to 5 microinch, rms. Although only a few holes were reamed in this test, a gradual decrease in hole size was apparent. Using conditions that, according to modern cutting fluid theory, tend to prevent the formation of a built-up edge, free-machining steel can be made to behave like bronze.

To establish reaming conditions that could be used in practice, a long series of reaming tests were carried out. During the tests, 3000 holes were reamed, 12,000 diameters were measured and about 1000 holes were measured for roughness.

Trichloroethylene is not suited for practical applications because of its volatility, toxicity and corrosiveness. A different cutting fluid is desirable. Therefore, a chemical emulsion cutting fluid was selected. For comparison purposes, a sulfurized mineral oil was used in the tests.

Test Results: Test materials were in the form of disks taken from large diameter bars. The disks were used in arbitrary sequence. In each disk, two rows of holes were centered with a combined center drill of a diameter larger than any of the tools subsequently used. This operation provided a chamfer in the top of the hole which was used to center the hole under the reamer in all following operations.

Special care was taken to start from accurately prepared holes. With the exception of one case in bronze the drilled holes were of exceptional quality.

The finished holes were measured with an air gage having an accuracy of 0.00004 inch. Four different diameters were selected for each hole. These were generally the maximum and minimum values near the top and the bottom of the hole. In one case, measurements were taken in arbitrary directions instead of measuring maximum and minimum values. Roughness values were measured with a Brush Surface Analyzer in microinch rms and with the Talysurf of Taylor, Taylor and Hobson in microinch A. A. (arithmetic average).

All the measurements were statistically evaluated

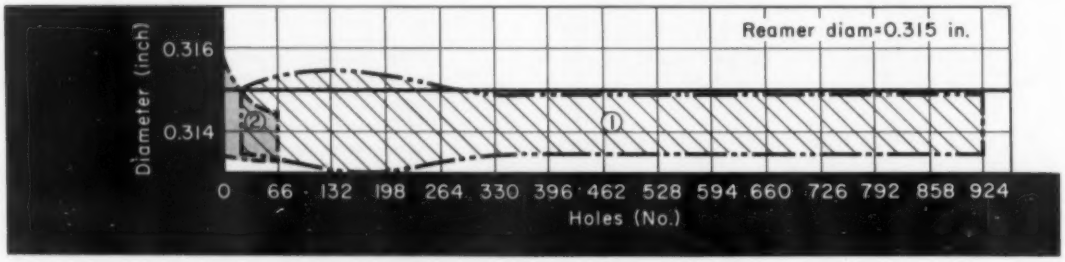


Fig. 6. Diameter deviations when reaming bronze with a carbide reamer and using mineral oil as cutting fluid in Test 1. In Test 2, free-cutting steel was reamed with a carbide reamer and trichloroethylene cutting fluid.

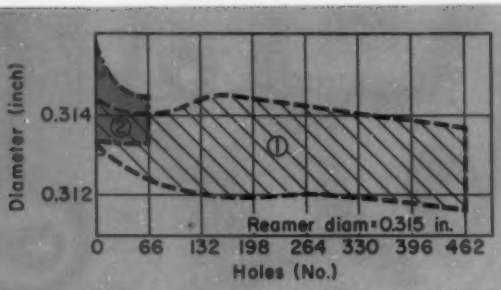


Fig. 7. Comparison of results found when reaming free-cutting steel with a carbide reamer and different cutting fluids. In Test 1, a chemical emulsion was used and Test 2 was made with trichloroethylene.

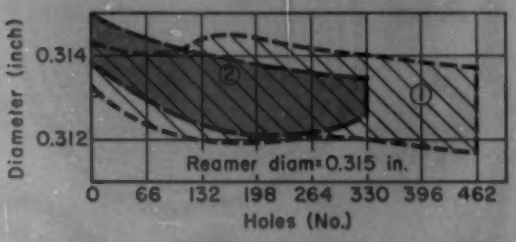


Fig. 8. Spread in diameters found in holes reamed with carbide reamers and a chemical emulsion type cutting fluid. Material used in Test 1 was free-cutting steel and in Test 2 was a medium carbon steel.

to render the maximum amount of information. Of this information, which included data on the taper and roundness of the holes, only the influence of wear is illustrated on the graphs.

Results of 2640 diameter measurements on 660 holes, reamed in one run with a high-speed steel reamer in free-machining steel are shown in *Fig.* 2. A sulfurized mineral oil was used for the cutting fluid. The letters A, C, U, D, etc. indicate the separate disks cut from one bar of steel. As can be seen from the sequence numbers under the graph, each disk contained 66 holes.

Measurements are grouped together for every eight or nine holes rendering 32 or 36 measured diameters at four measurements per hole. The dots give the arithmetic mean values for the diameter per group; the bands indicate the spread according to a normal distribution, and the standard deviation is calculated. In this case, the spread band represents four standard deviations. Often, the distribution showed considerable skewness and, in these cases, a band width containing 95 percent of the measurements was determined by the use of probability paper.

In most cases, the spread values calculated for each group of eight or nine holes—eight groups per disk—varied little for the 66 holes in one disk. Thus, the spread values could be blended into one value for every disk. In some cases, in the beginning of the reaming operation, there was a statistically significant regular increase in the spread values and this was considered when drawing the spread bands.

Based on an identical procedure, *Fig.* 3 shows the results of an analogous test run with a carbide reamer on bronze, using mineral cutting oil. Results are much less erratic and the blending together of mean values and spread bands into one continuous curve and one continuous spread band would have been acceptable.

Tests are shown in *Fig.* 4 which give results identical to the test of *Fig.* 2, only using a carbide reamer instead of a high-speed steel tool. The results are even more erratic than in *Fig.* 2, probably due to the inferior keenness of the cutting edge on the carbide reamer. It is evident that erratic behavior results in larger discontinuities from disk to disk as well as in wider spread bands.

In *Fig.* 5 the enveloping bands of *Figs.* 2, 3 and 4 are brought together in one diagram illustrating the two behavior patterns of steel and bronze. In *Figs.* 2 and 4 the erratic behavior of steel is shown by large spread values and lack of continuity in successive hole diameters. Considerable hole oversize tends to increase from hole to hole as well as continuing deterioration of surface condition.

Consistent behavior of bronze, *Fig.* 3, is brought out by smaller spread and greater continuity in successive hole diameters with holes measuring undersize. The tendency of hole size to decrease, in evidence when using high-speed steel tools, is not seen when using a carbide reamer.

In *Fig.* 6 is reproduced the enveloping band of *Fig.* 3 together with the short test on free-machining steel submerged in a bath of trichloroethylene. The reamer is carbide. The analogy is striking, especially when *Figs.* 2 and 4 were reviewed.

The results obtained with trichloroethylene can be produced equally well with a chemical emulsion cutting fluid as shown in *Fig.* 7. The free-machining steel reamed in this test was the same as in the trichloroethylene experiments. Here again a carbide reamer was used.

The test on free-machining steel using a chemical emulsion as cutting fluid is compared on *Fig.* 8 with an identical test on medium carbon steel. A considerable difference in machinability does not change the general picture. This is important as independence of workpiece machinability is essential if consistent hole size is to be produced under varying conditions.

Finally, reaming experiments were made in which four different brands of cutting fluids were

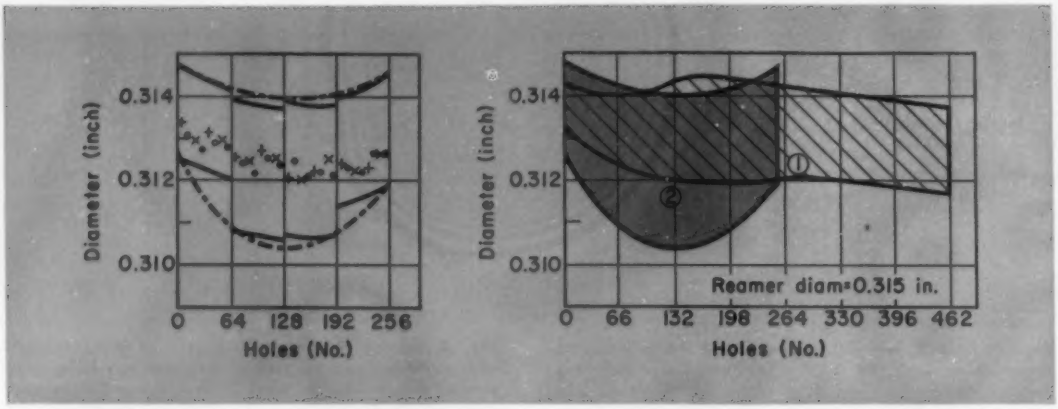


Fig. 9. Diagram based on the checks of holes reamed with a carbide reamer in free-cutting steel. Four different cutting fluids were used. Each plot represents the arithmetic mean of 16 diameters measured in eight holes during the test.

Fig. 10. Comparison of diameter spread in holes reamed with a carbide reamer in free-cutting steel. In Test 1, a chemical emulsion cutting fluid was used, while in Test 2, the fluids used in the tests plotted in *Fig.* 9 were employed.

used. The cutting fluid was changed after every eight holes in a test run over a total of 256 holes, using a carbide reamer on free-machining steel. Statistical evaluation of the diameter measurements shows no significant difference between the results obtained with the different cutting fluids. These results are given in one combined diagram, *Fig.* 9. This diagram shows the arithmetic mean diameter values and the spread bands, calculated by the same method as used in the previous graphs. A comparison is made between these last results and the data obtained with the chemical emulsion under identical conditions in *Fig.* 10.

Surface Roughness: Values of surface roughness, for each set of conditions are shown in *Fig.* 11. These facts show that:

Roughness values obtained on bronze are much lower than those obtained on steel when the cutting fluid is ineffective. The difference is highlighted more clearly by the arithmetic mean values of the roughness measurements than by the position of the spread bands. In the case of bronze, the frequency curves for the roughness show considerable skewness. This is due to the character of the surface defects which are localized, causing a small number of high roughness readings among a majority of lower readings.

Roughness values on steel, when using effective cutting fluids are better than the values obtained on bronze. The surface is similar to that obtained on bronze, only the local defects are absent.

The difference in the roughness patterns on bronze and steel, even if a built-up edge is absent in both cases, is believed to be a consequence of the discontinuous chip produced by bronze and the continuous chip of steel.

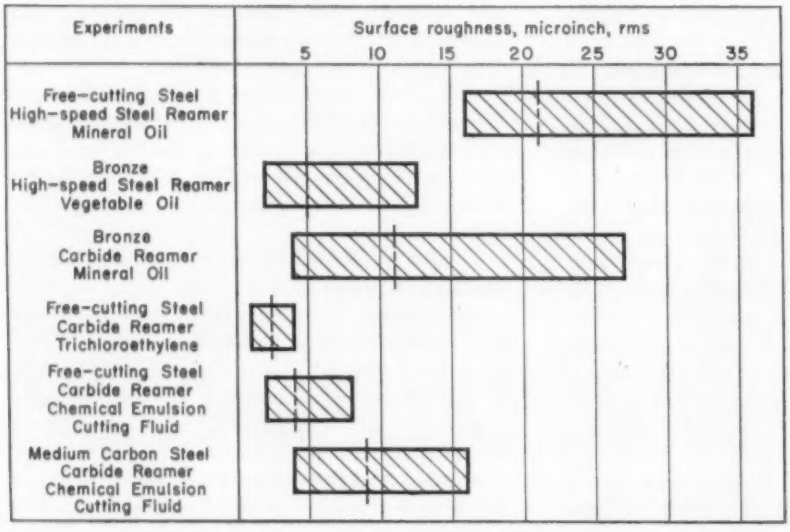


Fig. 11. Surface roughness of reamed holes machined in the various tests. Maximum, minimum and average values are shown in the bar charts.

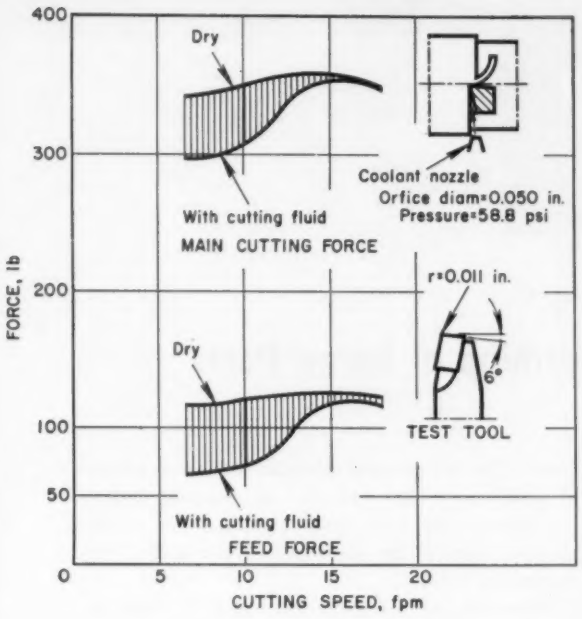


Fig. 12. Effect of cutting fluids on the cutting forces found in a lathe turning test of free-cutting steel.

Dynamometer Tests: In order to support the theory that built-up edge is responsible for poor reaming results and to establish the fact that suitable cutting fluids can change the mechanism of chip flow, dynamometer tests were performed. The dynamometer was a two-component meter based on the use of strain gages.[2] With the dynamometer, the main cutting force and feed force (tangential and axial components of the cutting force) were measured.

Bars of the same test materials were turned on a lathe and both force components measured and recorded. Halfway through the cutting test, a sharp jet of cutting fluid was directed at the tool tip between relief face and workpiece. The application of cutting fluid caused a sharp drop in cutting forces that could be measured on the graphs produced by the recording instrument.

The split curves of *Fig.* 12 give the main and feed force with and without the application of cutting fluid. This diagram shows that the cutting fluid is effective at low speeds but loses its effectiveness between 8 and 14 fpm.

Dynamometer tests show that there exists a speed range in which the cutting fluid becomes incapable of lowering the cutting forces. The same fact was found in the reaming tests where the criterion was the ability of the cutting fluid to improve reaming conditions of steel. Limiting speeds in reaming were found to be approximately 50 percent higher than in the dynamometer tests. This difference may be attributed to the smaller chip thickness in reaming and the difference in cutting fluid application.

The theory behind the comparison of reaming and dynamometer tests is that the cutting fluid provides real lubrication on the chip-tool interface through the formation of a chemical boundary layer of low shear strength. The formation of such an antiweld layer should also reduce the coefficient of friction on the face of the tool.

At higher cutting speeds, time is too short for the penetration of the cutting fluid and the formation of the chemical boundary layer. Thus, the effect is lost.

The fact that the predicted analogy between reaming behavior and cutting measurements was proved to exist may be regarded as a strong affirmation of the views put forward by Merchant and Shaw.[3] However, speed at which lubrication breaks down must be put at a considerably lower figure than the 40 fpm suggested by them. In these tests, the speeds are 12 to 25 fpm in the case of reaming and 8 to 14 fpm in the case of the dynamometer tests.

Practical Application: The tests make it clear that the reaming of holes in steel need not be a hit-or-miss operation. By appropriate use of the modern cutting fluids at low speed, an extremely high dimensional accuracy together with excellent surface condition can be realized.

Low reaming speed can be partly compensated for by the use of higher feeds. Still, it must be admitted that the method is not attractive in mass production, where speed and efficiency are the prime objectives. In the toolroom and in the manufacture of high precision instruments and machines, the method is useful.

The experiments were carried out with great care and precision to produce consistent results. This condition bears out that the whole setup of a precision reaming operation requires great accuracy in reamer geometry as well as in the centricity of the reamer in the hole. Simple drilled holes usually lack straightness or roundness. They must be corrected before reaming by an intermediate operation.

In the first stages of the experiments, attempts were made to use a floating reamer for the tests but no reproducible results could be obtained. The use of a rigidly mounted reamer, together with adequate precautions to assure concentricity appears to be essential at this accuracy level.

References

1. Shaw, M. C.—*Cutting Fluid Theory, Machining Theory and Practice*, Published by American Society for Metals, p. 61, 1950.
2. ten Horn, B. L. and R. A. Schuermann—"A Two Component Lathe Dynamometer," *Microtecnic*, Vol. XI, 1957.
3. Merchant, E. and M. C. Shaw—"Machining, Theory and Practice," presented at the 31st National Metal Congress, American Society for Metals, Cleveland.

designed for

PRODUCTION

Tracer-Controlled Roll Forming of Large Parts

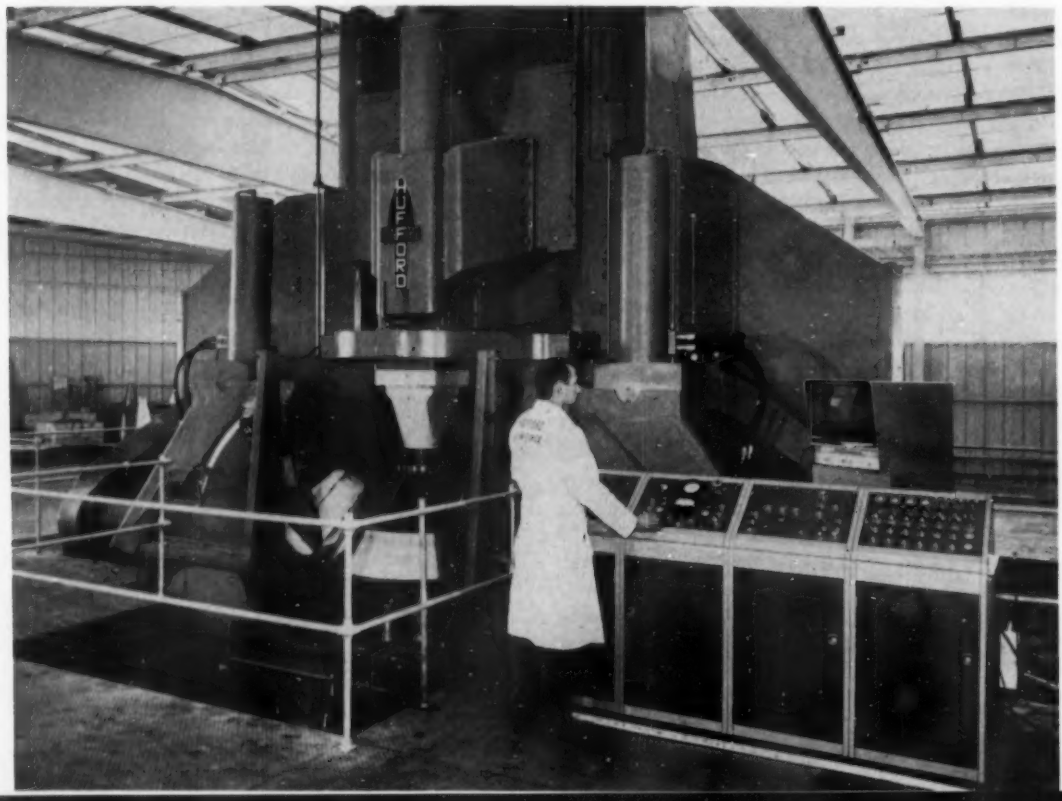
Power-roll forming combines the principles of metal spinning and roll forging into a single shearing-spinning operation. Parts of revolution, hollow cones, cylinders and hemispheres, with tapered skins and integral reinforcement, can be accurately produced with savings in material.

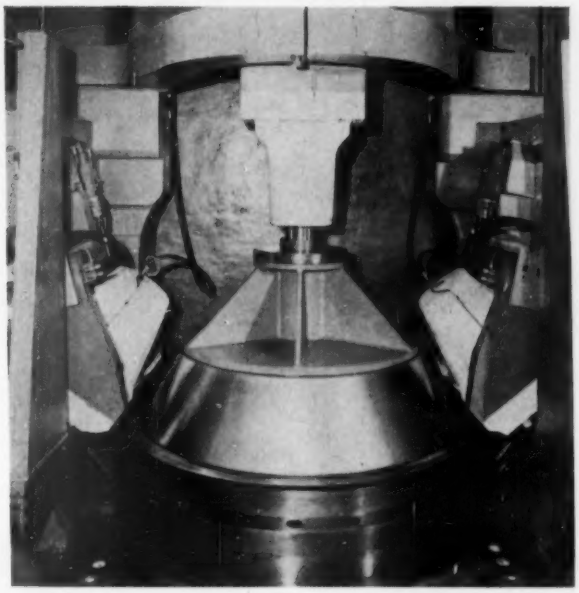
A machine tool, known as the "Spin Forge," has been developed by the Siegler Corp.'s Hufford Div. to power-roll form materials as thick as one inch, Maximum size of the parts that may be formed is 60 inches in diameter and ten feet in height.

In forming a component, the blank is placed on a mandrel shaped like the desired part and held in place by a vertical tailstock that can exert a hydraulic force of 200,000 pounds. The mandrel is then rotated at speeds up to 400 rpm, and two working rollers, set across from each other at either side of the mandrel, contact the material to force it over and around the form.

Automatic control of the machine is provided by use of an electrohydraulic tracer system. Developed by Minneapolis-Honeywell Regulator Co., the system controls the one million pounds of hydraulically applied roller force to produce parts within ± 0.003 inch. During operation, the electronic tracing head follows a template to operate a hydraulic servo-valve which in turn controls the variable volume pump of the 3000 psi actuating system.

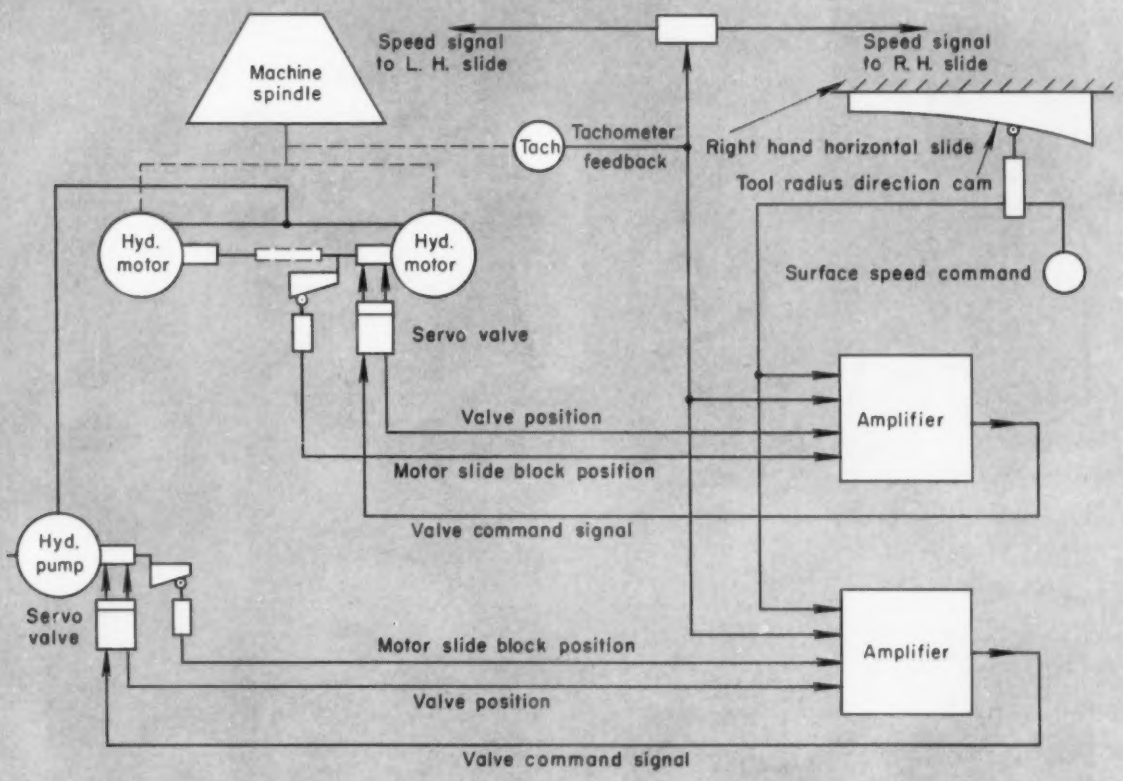
MACHINE for forming one inch thick materials into surface of revolution as large as 60 inches in diameter and 10 feet long. Action of the forming rolls is observed by the operator in the television set behind the console.





TRUNCATED CONE PART of stainless steel is held in place for the forming operation by a vertical tailstock. During operation, the mandrel is rotated and the tool rings, located at either side of the mandrel, move in and exert up to 225,000 pounds of force both horizontally and vertically on the metal.

SCHEMATIC DIAGRAM (below) of the servo control system. Transistorized servo amplifiers interpret signals from the stylus head, which contacts the control template, to make corrections in the roll positions during the operation.

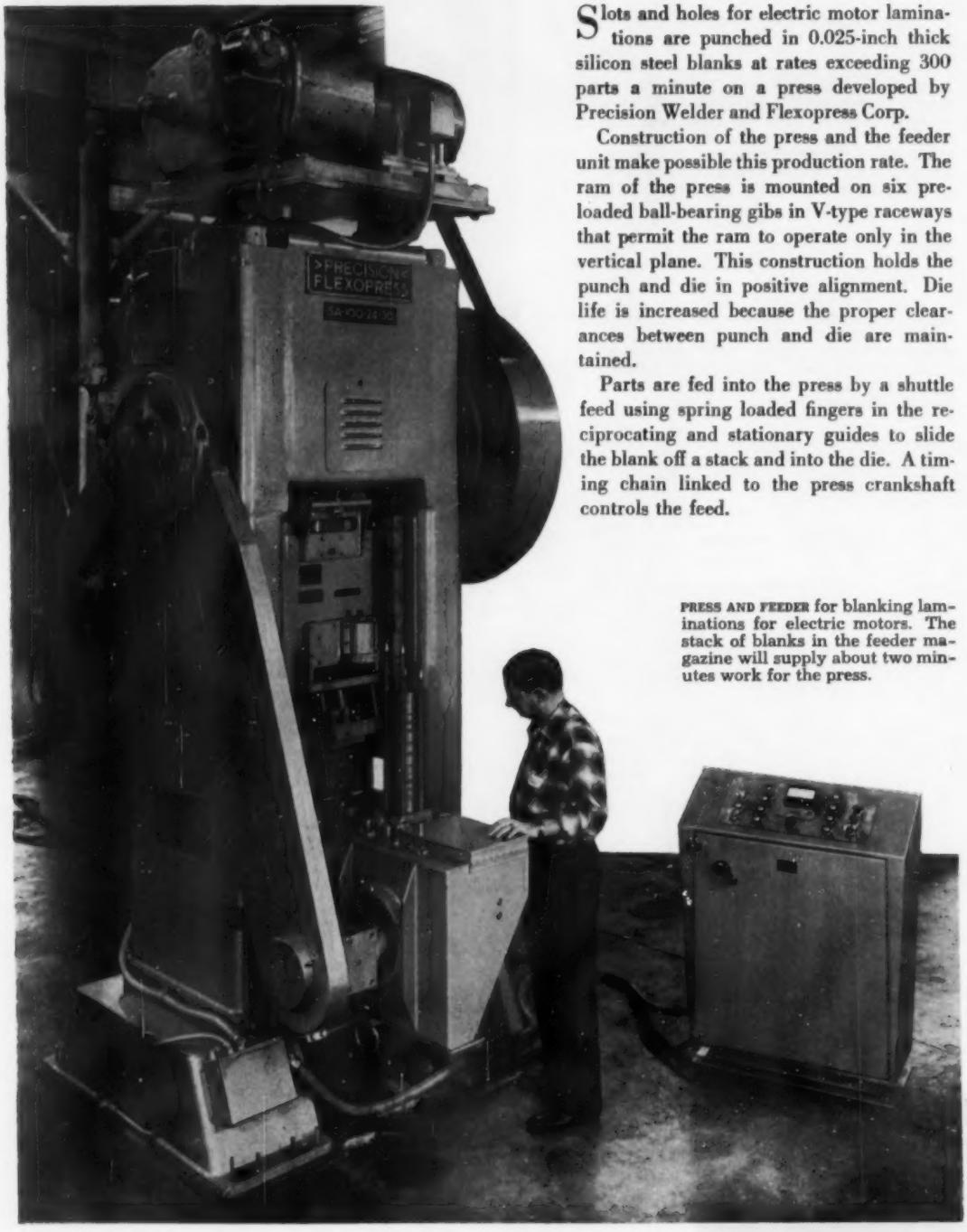


Vertical Press Produces 300 Laminations Per Minute

Slots and holes for electric motor laminations are punched in 0.025-inch thick silicon steel blanks at rates exceeding 300 parts a minute on a press developed by Precision Welder and Flexopress Corp.

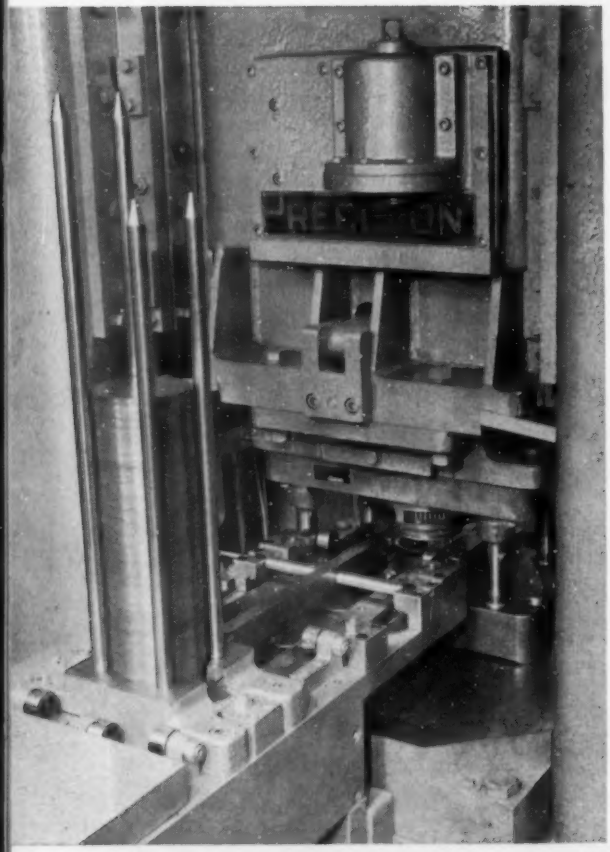
Construction of the press and the feeder unit make possible this production rate. The ram of the press is mounted on six preloaded ball-bearing gibs in V-type raceways that permit the ram to operate only in the vertical plane. This construction holds the punch and die in positive alignment. Die life is increased because the proper clearances between punch and die are maintained.

Parts are fed into the press by a shuttle feed using spring loaded fingers in the reciprocating and stationary guides to slide the blank off a stack and into the die. A timing chain linked to the press crankshaft controls the feed.

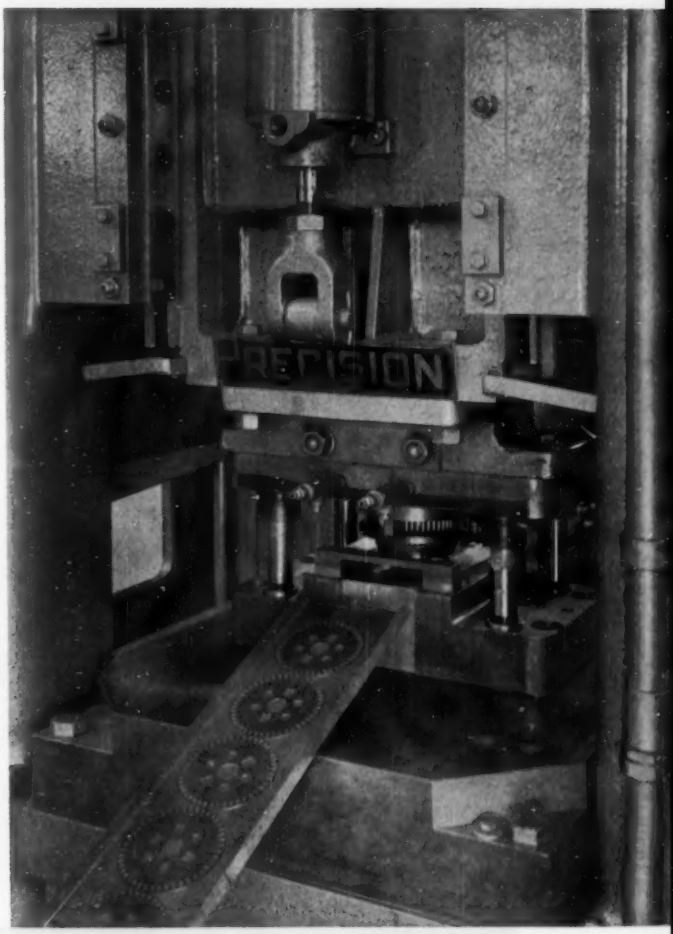


PRESS AND FEEDER for blanking laminations for electric motors. The stack of blanks in the feeder magazine will supply about two minutes work for the press.

BLANK, called a "cookie", and a finished lamination of 0.025 inch silicon steel. Holes and slots are perforated in one operation of the die.

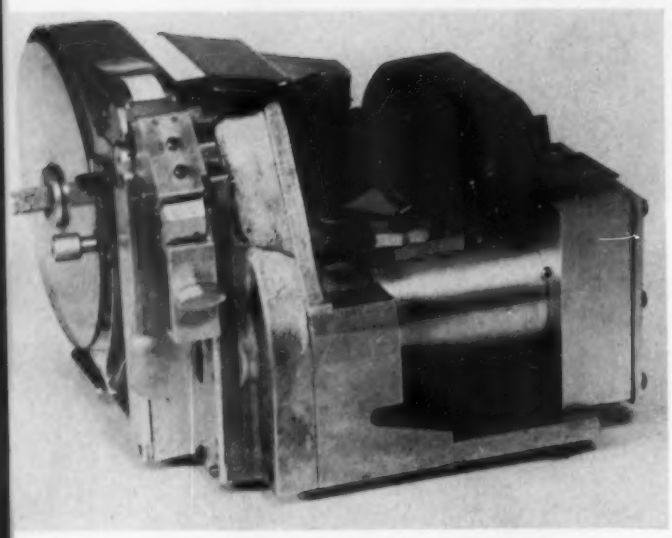


LOADING DEVICE in operation with blanks passing into the die area for perforation of holes and slots. Blanks slide off the bottom of stack into the feed unit.



FINISHED LAMINATIONS leaving the press. Parts are mechanically fed into and out of the die area for the control necessary in fast automatic production.

Definite-Position Clutch for Rotating Machinery

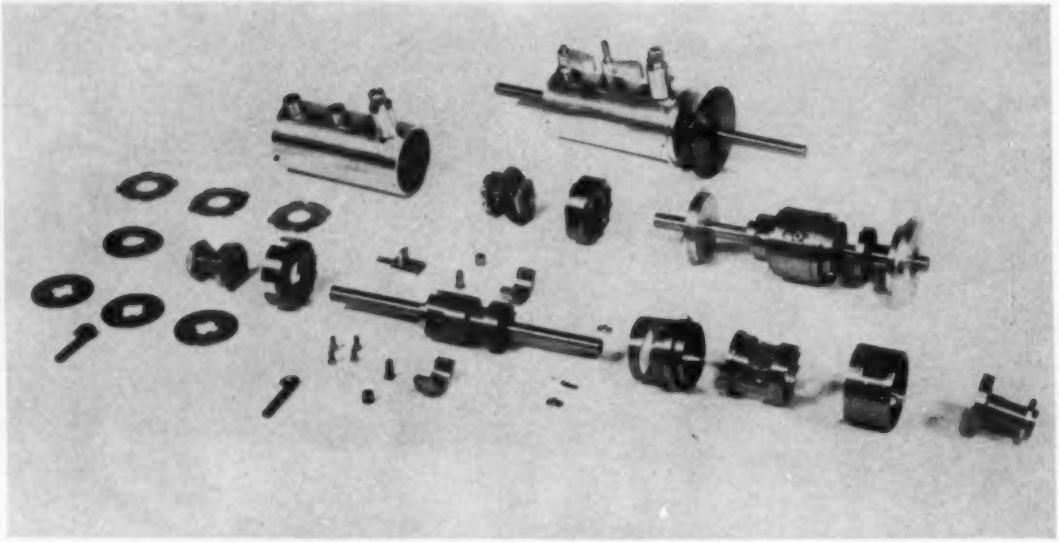


APPLICATION of the clutch to a ticket printing machine. The clutch is driven by a motor through a reducer unit to regulate the feed, printing and cutoff of labels.

A single-revolution clutch, developed by Tickamatic Corp. of Port Washington, N. Y., is capable of controlling rotating machinery for exact indexing without danger of creep, overrunning or hammering. The unit has been used on punch presses, duplicating, packaging, coil-winding and other automatic machinery. Control speed can be varied from one to 1725 rpm with the unit operating under a torque of 10 ft-lb.

The clutch has three main members—an engaging sleeve, a disengaging sleeve and a driven element or spool. For single-revolution operation, the spool is equipped with a pawl which is free to slide on the spool.

Operation of the unit begins by lifting the latch, which permits the spring to operate the engaging sleeve. This action slides the spool into engagement with the driver while the disengaging sleeve remains in neutral. When the pawl comes around, it hits a shoe which moves the disengaging sleeve into the driver to rotate both sleeves. This rotation disengages the spool, then the disengaging sleeve and allows the latch to drop in front of the shoulder to prepare for the next cycle.



AN EXPLODED VIEW of the clutch in various stages of assembly. Detail components and subassemblies are positioned relative to the final assembly. A complete unit shows compactness of clutch.

PLASTICS solve forming problem

By Wilbrod E. Picard*, Tool Supervisor and **John Kilduff**, Chief Engineer
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Low-volume production and short schedules demand low-cost tooling. Plastics tooling is particularly useful for keeping costs at a minimum in stamping operations. Methods and procedures for making these tools are discussed in this article.

LIMITED PRODUCTION of complex stampings is expensive due to the high cost of tooling and the long lead time required to design and produce the tools. Such a problem was encountered in the production of 1200 parabolic reflectors from 0.035 inch thick brass. Estimated time for making a steel punch for the job was 75 hours.

Fabricating the reflector requires six operations after blanking. They are drawing the blank, turning the flange, edging the flange, piercing, plating and polishing. By the nature of the part, plastics tooling, *Fig.* 1, may be used for the forming operations.

During the evaluation of plastics tooling methods, plastic laminates were eliminated because of the time involved. Lay-up, wetting, tailoring and finishing techniques of the method require training. Although the training period is short, a tight delivery schedule ruled out its use.

Preforms and other plastics involving heat curing were not considered practical for this application. In addition to requiring a training period, investments in an oven, heating unit, and other equipment

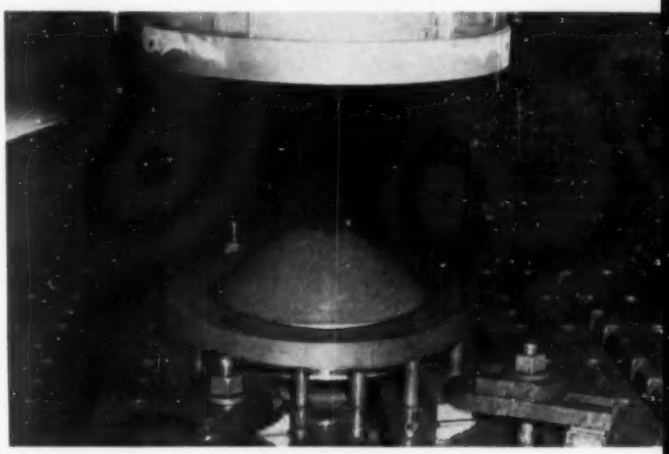

Fig. 1. Plastics punch and hold-down ring to form flange on a parabolic reflector.

*Senior member ASTE Merrimack Valley chapter.

Properties of Steel-Filled Epoxy Casting Resin

Compression strength, psi	18,000
Shrinkage, in. per in.	0.0005
Surface finish, microinch rms*	1
Curing time, hr	2
Curing heat required	none
Curing pressure required	none

*As cast, direct duplication of model surface.

offset cost advantages that plastics tooling had over steel for this job.

Straight epoxy casting resins have the advantage of ease of use but the physical properties of the unfilled resins were not suited to the job. Filling the resins, or self-formulating, was not practical because time did not permit the trial and error necessary to obtain consistent results. Preformulated casting resin, however, proved to be a practical solution to the problem. After considering several types, Plastic Steel manufactured by Devcon Corp. was selected. Characteristics of this material are shown in the table.

To make the plastics die components, a wood pattern was made for a spinning chuck. Then, a reflector was spun from 0.032-inch brass sheet.

After the spun reflector was coated with a release agent, a thin shell of the steel-filled resin was brushed over its surface. This step eliminates any air bubbles in the finished surface of the punch. Following the surface preparation step, resin was poured slowly into the model mold to prevent air entrapment in the completed tool.

Two hours after pouring, the punch was released from the model. It was then drilled, tapped and mounted to an adaptor. Since no further machining or polishing was necessary, the unit was mounted immediately on a Bliss No. 4 double-action press, *Fig.* 2, to facilitate production.

To make the die, two steel hoops were mounted on a 0.050-inch steel base to serve as the mold. This mold was then coated with a release agent. After coating, the resin mixture was poured into the mold and allowed to harden while in contact with the punch. Two hours later, the die was removed from the mold and faced for proper clearance and radius. It was located on a machine steel base and mounted on the bed of the press.

A hold-down was constructed by the same method for producing the die and then mounted to the outside ram of the press.

These components were used to draw the blank shown in *Fig.* 2. A standard drawing lubricant was used since the plastics die is unaffected by most oils, solvents and chemicals.

Using the same procedure, another die and punch were made to turn the flange. These tools were mounted on the Bliss air-cushion press shown in *Fig.* 3 for this operation.

For the third operation, edging the flange, the plastics punch was used as a form. Piercing, plating and polishing were done by conventional methods. *Fig.* 4. At the end of the run, no visible signs of wear were apparent on the tools. The die components were stored for future use.

This application of plastics tooling has been responsible for its use on other jobs. Jigs and fixtures, as well as dies, have been made by this method to meet stringent delivery dates and to furnish inexpensive tooling.

Fig. 2. Part being removed from the die after draw operation.

Fig. 3. Inspection of part after completion of flanging operation in the plastic die.

Fig. 4. (right) Reflectors in various stages of production: Left to right are drawn, flange turned and finished part.

how to cut
DRILLING COSTS in small-plant operations

By Clement F. Brown
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When drilling feeds and speeds are left entirely to the discretion of machine operators, efficiency may suffer. The answer is to provide operators with charts showing recommended speeds and feeds for various work materials and conditions. Frequent spot checks by tool engineers will show whether or not the recommendations are being followed.

About 20 percent of the machine tools in this country are drilling machines of one kind or another. Accordingly, drilling operations offer a large field for methods improvement that cannot be overlooked by any tool engineer. In larger companies with mass production operations, tool engineers have more or less complete control of drilling efficiency. Process instructions prepared for each part contain all necessary information and instructions for manufacturing and usually include feeds and speeds for drilling. When problems arise, methods engineers or time study engineers study the job on the shop floor and correct the situation.

In smaller companies with limited staffs, it is not possible to give individual jobs such close attention, particularly when production runs are short. Drilling efficiency is largely controlled by foremen and machine operators, *Fig.* 1. Sometimes this results in satisfactory operations; in other cases production minutes per part are excessive.

Production Time: Several factors control production time on any machine tool operation. Generally, these factors are setup time, cycle time—which includes handling and machining—tear-down time, and miscellaneous allowances. The latter include personal time, fatigue allowance, tool sharpening and changing, checking of first workpiece and similar elements. All of these elements except machining time require some form of direct participation or action on the part of the machine operator. Usually, little or no productive effort is put forth by the operator during this part of the production cycle. For over-all improvement in efficiency, maximum machine output must be attained during this period.

In drill press operations, the ratio of handling time to machining time varies greatly, depending on the nature of the job. For example, the job shown in *Fig.* 2 requires lifting and clamping a heavy part by crane to drill one or two holes. In this case, handling time greatly exceeds actual machining time. Drilling, reaming or flycutting (trepanning) of numerous closely spaced holes in a heat exchanger or boiler tube sheet, on the other hand, is a different situation, *Fig.* 3. Here, after the setup is made, drilling time consumes most of the total production time. Most jobs are somewhere in between these two extremes. Control becomes more important as machining time becomes higher. Even when the ratio is small, maximum efficiency is desirable.

Optimum performance during the machining cycle is largely a matter of proper feed and speed selection. The allowable cutting speed for any specific material governs this selection. Allowable speeds are principally controlled by the machinability of materials and cutting tool hardnesses. All other factors being equal, the softer the material and the harder the tool, the higher the allowable cutting speed. The same statement is true for feed rates. Some of the other conditions that influence feed and speed selection are:

1. Type of drill press
2. Condition of the machine (largely its ability to resist thrust)

—Photo courtesy Carlton Machine Tool Co.

Fig. 1. Efficiency of modern drilling machines can be enhanced by using correct feeds and speeds for given workpiece, tool and cutting conditions. Use of preselect unit that controls spindle speed and feed changes automatically on this drill also improves efficiency, as does the use of quick-change toolholders.

3. Rigidity of the workpiece and the clamping arrangement
4. Depth of hole being cut
5. Design and sharpness of the cutting tool
6. Type and flow of lubricant.

Some of these conditions are related to the condition of the machine rather than the tool or workpiece. Most such conditions can be changed to suit an individual job or operation. Thus the material and the tools are the prime factors for consideration in proper feed and speed selection.

Selecting Cutting Speeds: Cutting speed is a linear rate of surface travel of the tool or part, usually expressed in terms of feet per minute. Where C is cutting speed in feet per minute D is hole diameter in inches and S is revolutions per minute of the tool, the cutting speed formula is $C = 0.262D \times S$. For example, the cutting speed of a ¾-inch diameter drill operating at 460 rpm is $0.262 \times 0.750 \times 460 = 90.4$ fpm.

The cutting speed calculated in the example would normally be acceptable for drilling mild carbon steel with a high-speed steel drill. It would be decidedly too fast for harder materials, such as stainless steel. On the other hand, freer machining materials—aluminum or brass—could be drilled at much higher speeds. Use of a carbon steel drill would call for a considerable reduction in cutting speed when operating under the same conditions as a high-speed steel tool. In the same circumstances, carbide-tipped drills could operate at substantially increased speeds.

Specific Recommendations: There is no shortage of written information and recommendations on the subject of feeds and speeds. However, recommendations from different sources rarely coincide. Despite these differences, the tool engineer must decide on one cutting speed and feed for drilling a hole of given size in a specific material. The following recommendations have been found useful for cutting with high-speed steel drills and cutting tools.

Medium-hard materials include low and medium-carbon structural and machinery steels, low-alloy steels (0.10 to 0.30 percent carbon), cast iron (medium and soft), bronze of medium hardness and naval brass. Cutting speeds for these materials range from 50 to 150 fpm. Recommended feeds range from 0.001 to 0.002 ipr for drills under ⅛-inch diameter; 0.003 to 0.006 ipr for ⅛ to ¼-inch drills; 0.006 to 0.011 ipr for ¼ to ½-inch drills; 0.011 to 0.019 for ½ to 1-inch drills; and from 0.015 to 0.034 ipr for larger drills up to 3 inches in diameter.

Hard materials include high-carbon alloy and tool steels, stainless steels, Monel metal and hard bronze. Cutting speeds range, on the average, from 25 to 75 fpm. Allowable feeds are approximately two thirds of those for the medium-hard metals.

Brass, soft bronze, aluminum and magnesium are good examples of soft materials. Cutting speeds range from 150 to 400 fpm. Feeds are about one

—Photo courtesy Carlton Machine Tool Co.

Fig. 2. When drilling a heavy workpiece with only a few holes, actual drilling time is only a small part of total production time. Handling time is large.

third higher than those suggested for the medium-hard group.

Several types of operations allied to drilling are often performed on various types of drill presses. Machine reaming is usually done at somewhat reduced speeds and increased feeds as compared to drilling. Tapping speeds are substantially lower, while feeds are increased, being governed by the thread lead. Speeds for flycutting are comparable to drilling, speeds. Feeds, however, are greatly reduced because of the usual lack of rigidity of tools and holders used in such operations.

An "average" recommended cutting speed for medium-hard materials is 90 fpm; for hard materials it is 50 fpm; for soft materials it is 250 fpm. In making feed and speed selections, it is generally more economical to use low feeds and speeds rather than high ones. For instance, a high-speed drill, cutting low-carbon steel, may stand up satisfactorily when operating at a speed of 150 fpm. At this speed,

Recommended Feeds and Speeds for Radial Drill Press

Tool Diameter (inch)	Medium-Hard Material		Hard Material		Soft Material	
	Speed (rpm)	Feed (ipr)	Speed (rpm)	Feed (ipr)	Speed (rpm)	Feed (ipr)
Drilling						
3/16—15/64	1500—1286	0.004—0.006	1100—772	0.004	1500	0.004—0.006
1/4—23/64	1286—900	0.006—0.011	772—503	0.004—0.008	1500	0.008—0.015
3/8—31/64	900—660	0.008—0.011	503—375	0.006—0.008	1500	0.015—0.019
1/2—39/64	660—537	0.011—0.015	375—302	0.008—0.010	1500—1286	0.015—0.024
5/8—47/64	537—460	0.011—0.015	302—258	0.008—0.010	1286—1100	0.015—0.024
3/4—55/64	460—375	0.011—0.019	258—212	0.010—0.013	1100—900	0.019—0.026
7/8—63/64	375—322	0.011—0.019	212	0.010—0.013	900	0.019—0.026
1—1 7/64	322—302	0.011—0.019	212—179	0.010—0.015	900—772	0.019—0.026
1 1/8—1 15/64	302—275	0.015—0.022	179—155	0.013—0.019	772—660	0.022—0.026
1 1/4—1 23/64	275—258	0.015—0.022	155—147	0.013—0.019	660	0.022—0.026
1 3/8—1 31/64	258—245	0.015—0.022	147—127	0.013—0.019	660—625	0.022—0.026
1 1/2—1 39/64	245—212	0.015—0.022	127—115	0.013—0.022	625—587	0.022—0.034
1 5/8—1 47/64	212—181	0.015—0.022	115	0.013—0.022	587—537	0.022—0.034
1 3/4—1 55/64	181	0.015—0.022	115—109	0.013—0.022	537—503	0.022—0.034
1 7/8—1 63/64	179	0.015—0.022	109—94	0.013—0.022	503—460	0.022—0.034
2—2 15/64	179—155	0.022—0.034	94—88	0.013—0.022	460—430	0.022—0.034
2 1/4—2 31/64	155—147	0.022—0.034	88—75	0.013—0.022	430—375	0.026—0.041
2 1/2—2 47/64	147—127	0.022—0.034	75—71	0.013—0.022	375—352	0.026—0.041
2 3/4—3	127—115	0.022—0.034	71—64	0.013—0.022	322	0.026—0.041
Flycutting						
3—3 1/2	115—94	0.006—0.008	60—55	0.004—0.006	258—212	0.006—0.011
3 1/2—4	94—82	0.006—0.011	55—45	0.006—0.008	212—181	0.008—0.013
4—4 1/2	82	0.008—0.013	45—42	0.006—0.010	181	0.010—0.015
4 1/2—5	82—71	0.008—0.015	42—39	0.006—0.010	181—155	0.011—0.017
5—5 1/2	71—65	0.010—0.017	39—36	0.006—0.010	155—147	0.013—0.019
5 1/2—6	65—60	0.011—0.019	36—30	0.008—0.013	147—127	0.015—0.022
6—8	60—42	0.011—0.024	30—21	0.011—0.015	127—94	0.015—0.026
8—10	42—34	0.015—0.026	21—18	0.011—0.019	94—75	0.019—0.034
Reaming						
1/4—3/4	258—208	0.006—0.013	258—155	0.006—0.013	258	0.013
3/4—1 1/4	208—125	0.019	155—94	0.015	258	0.019
1 1/4—1 3/4	125—88	0.026	94—65	0.019	258—181	0.026
1 3/4—2 1/2	88—60	0.034	65—45	0.026	181—127	0.034
Tapping (standard threads)						
1/4-20—1/2-13	245—181		212—115		245	
1/2-13—1-8	181—96	Lead	115—53	Lead	245—134	Lead
1-8—1 1/4-7	96—75	of	53—45	of	134—109	of
1 1/4-7—1 3/4-5	75—53	Thread	45—34	Thread	109—75	Thread
1 3/4-5—2 1/4-4 1/2	53—42		34—26		75—60	

Tool material is high-speed steel. Medium-hard materials include low and medium carbon steel, cast iron and medium bronze. Hard materials include high carbon and cast steel, hard bronze, Monel metal. Soft materials include brass, aluminum, soft bronze, magnesium. These recommendations were developed for a specific machine.

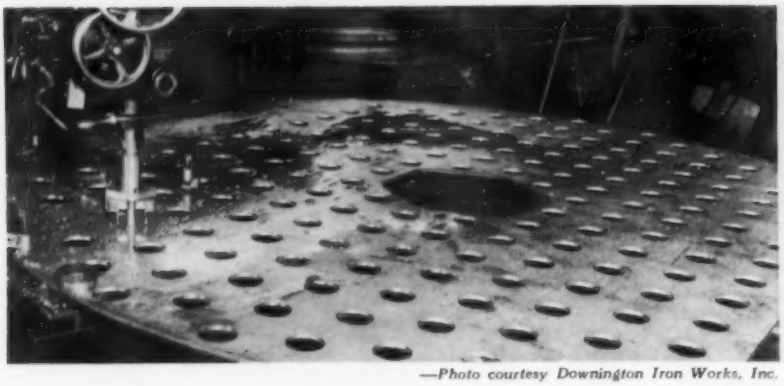


Fig. 3. Machining time takes up most of total production time when flycutting holes in this stainless plate.

—Photo courtesy Downington Iron Works, Inc.

however, excessive drill wear, requiring frequent tool regrinding, will in most cases offset gains made in machining time. The most economical cutting speed may be 100 fpm. The best approach is to start at moderate rates of speed and feed, gradually increasing until maximum efficiency is reached.

Work Sampling: Making sure that efficient speeds and feeds are actually used can be a difficult problem. It is impossible for a tool engineer to check all drilling operations in the average small shop. Drilling feeds and speeds can be investigated, however, by using work sampling techniques. These techniques are a quick and inexpensive method of acquiring information without making prolonged or continuous observations.

During visits to the shop, the tool engineer selects a few operations for spot checking and notes:

1. Date of observation
2. Job or operation number (optional)
3. Material being machined
4. Tool size, depth of hole and similar job information
5. Spindle speed in revolutions per minute
6. Spindle feed in inches per revolution.

After each job is observed, the information is placed on a form similar to the one shown in *Fig.* 4. A separate form should be used for each piece of drilling equipment covered in the study. After entering the information, the cutting speed for each operation is calculated.

One or two spot observations per day will make it possible to compile the needed facts within a reasonably short time. The observations should be continued until there is sufficient information to obtain a good picture of average shop performance. Studies taken at random will give best results and spur-of-the-moment observations are preferred. Observations should not be made at any specific time. This approach eliminates prejudice or other considerations that may influence work sampling.

A comparison between actual speeds and feeds recorded on the form and the "average" recommended feeds and speeds for the three classes of material (90 fpm for medium-hard materials, 50 fpm for hard materials and 250 fpm for soft materials) will show whether or not drilling efficiency is satisfactory. It is convenient to record this information directly on the work sampling form. If the actual feed or speed is within 10 percent of the "average," a 0 is placed on the form. When the factor is higher than recommended, a plus sign is marked on the form; if it is lower than recommended, a minus sign is recorded. The results are then summarized. If the percentage of minus signs is high, some action to improve drilling efficiency should definitely be taken.

Operator's Guide: If possible, staff attention should be devoted to improving efficiency. This may be in the form of process instructions for all or some portion of the drilling work. On-the-spot attention to some operations may be the answer. An effective, yet simple, approach that can be taken in even the smallest organization is to provide foremen and operators with a definite guide. The guide will of necessity be general in nature. It will not provide 100 percent control or cure for the situation. However, with the cooperation of shop personnel steady improvement will result.

One form of guide that has given good results is a table showing average recommended speeds and feeds for a variety of the more common drill press operations. The accompanying table was developed specifically for a heavy-duty Type 3A Carlton radial drill with a 17-inch column and a 6-foot arm. It gives recommended speeds and feeds for drilling, flycutting, reaming and tapping materials in three hardness ranges. Where a range of feeds and speeds is given for a specific operation, the lower part of the range is for the smaller tools in the group and the high part of the range is for larger tools.

The "average" recommended speeds were used in developing the table. These are expressed in revolutions per minute. Feet per minute can be convert-

MACHINE TOOL OPERATION INVESTIGATION

SPEEDS AND FEEDS

Machine Tool: TYPE 3A CARLTON RADIAL - 17" COL. - 6 FT ARM

Made by: CFB Date Started: 10/22 Completed: 11/7

Date	Job No.	Material	Job Information	Machine Setting		Cutting Speed (fpm)	
				Feed (ipr)	Speed (rpm)		
10/22	3324	.25C H.R. STEEL	5/8"-11 TAP - 1 1/16" THRU HOLE	(0) (THD. LEAD) .091	115	(-)	18.8
10/23	3261	.35 C H.R. STEEL	2 1/32" DRILL - 2 7/8" DP. - (1 1/16" PILOT HOLE)	(0) .034	179	(0)	95.2
10/25	3120	TYP. 304 ST. ST.	3/8" DRILL THRU - 15/16" THICK PC.	(-) .004	275	(+)	54.0
"	3459	.25C H.R. STEEL	6 1/16" DIA. FLYCUT - 1/4" PLATE (13/16 PILOT HOLE)	(-) .006	30	(-)	48.0
10/28	3591	"	3/4" DRILL THRU - 1/4" TH. PLATE	(-) .008	460	(0)	90.4
"	"	"	3/16" " " - " " "	(0) .004	460	(-)	22.5
10/30	3170	C-1030 FORGED ST.	1" DRILL - 1 1/2" DEEP	(-) .008	460	(+)	120.5
11/4	"	"	1 1/8"-7 TAP - 1 3/8" DEEP	(0) (THD. LEAD) .143	179	(+)	52.8
11/5	3429	.30 C H.R. STEEL	1" DRILL THRU - 4 1/2" TH. (2 PCS @ 2 1/4" STACKED)	(-) .004	275	(-)	72.1
11/6	3329	"	1 1/8" DRILL THRU - 2 1/4" TH. (USING DRILL JIG.)	(-) .008	275	(0)	81.0
11/7	3170	"	21/32" DRILL - 1 13/16" DEEP	(-) .004	460	(-)	79.0
"	3596	TYP. 304 ST. ST.	13/16" DRILL THRU - 3/4" TH. PLATE	(-) .006	212	(0)	45.1

Fig. 4. Typical form for accumulating work sampling data. Such forms record spot checks of actual production feeds and speeds, often indicate the need for correction.

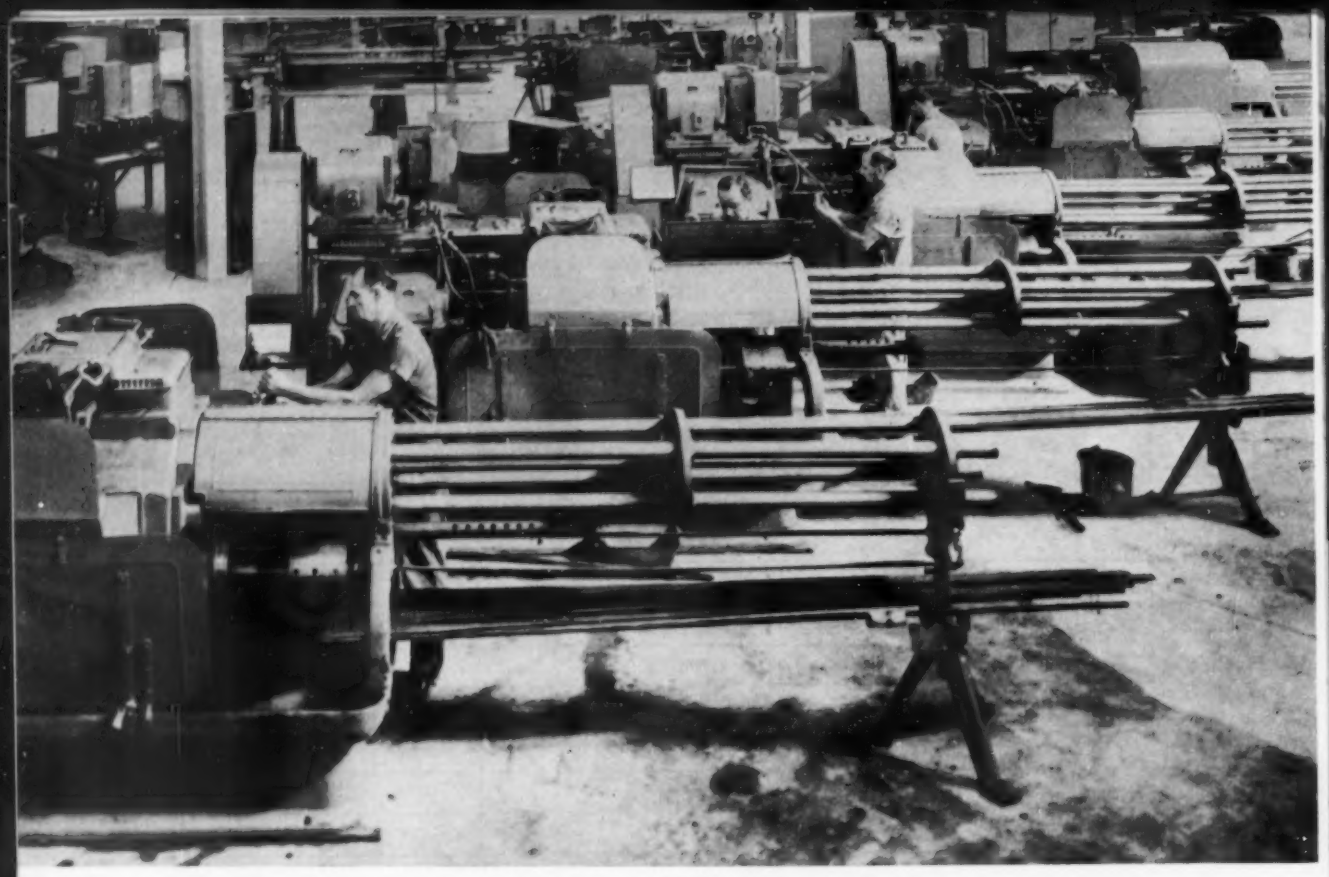
ed to speed, S in rpm, by use of the formula: $S = C/0.262 \times D$. In the case of medium-hard materials being machined with a 1½-inch diameter drill, the calculation is $90/0.262 \times 1.5 = 229$. For hard materials the speed is 127 rpm; for soft materials the speed is 636 rpm, using the formula. In making the chart, considerable calculation can be saved by consulting handbook tables that give the values for revolutions per minute when surface speeds and tool diameters are known.

Once speed and feed values have been calculated, they are recorded on the table. These ideal values, however, will rarely coincide with the available speeds on any drill press under consideration. The nearest speed available must be selected.

In most instances, the next lowest speed, or perhaps one that is only slightly higher, may be close to the calculated value. Values can be held fairly close with the Carlton radial drill since 48 spindle speeds are available for selection. On older machines, where there are usually fewer selections, it is more difficult to attain optimum efficiency.

The advantage of the table is that information of practical value is presented to the machine operator. For a given tool size and a certain class of material, definite recommendations are made. The table is presented as a guide, rather than as a definite recommendation. Operators are instructed to start the job using the values shown in the table. If an operator feels that a change is desirable, he contacts the foreman and the foreman and operator make a decision, for which the foreman is responsible. In actual practice, the data in the table should be found acceptable most of the time. If not, they will certainly bear review.

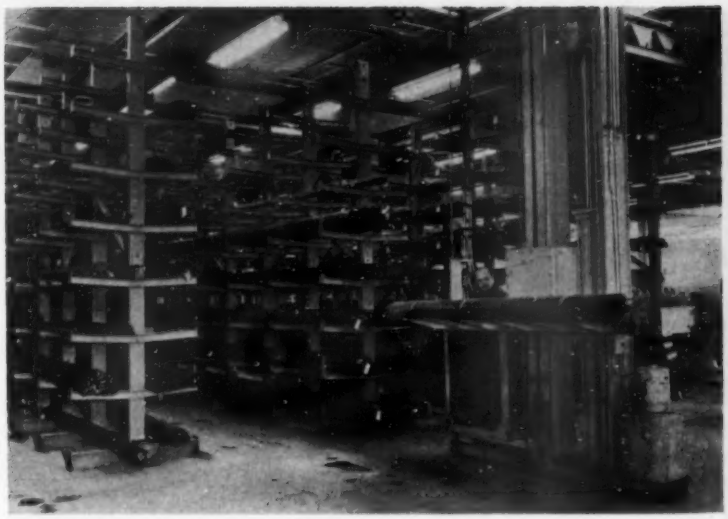
The speed and feed tables are especially helpful to the small organization lacking staff assistance to supply detailed information for each operation. They are also helpful to engineers engaged in processing and production planning. So far as possibilities for improvement are concerned, in one plant where this program was followed through to completion, a 20 percent reduction in drilling time was realized. Such improvement is well worth the attention of any tool engineer.



SCREW MACHINE DIVISION of the new Bloomfield, Conn., plant of The Allen Mfg. Co. This plant comprises a 250,000-square-foot factory section and a 20,000-square-foot office building. The main factory features a 10,000-square-foot pilot plant where new machines, materials, and manufacturing processes are tested prior to use.

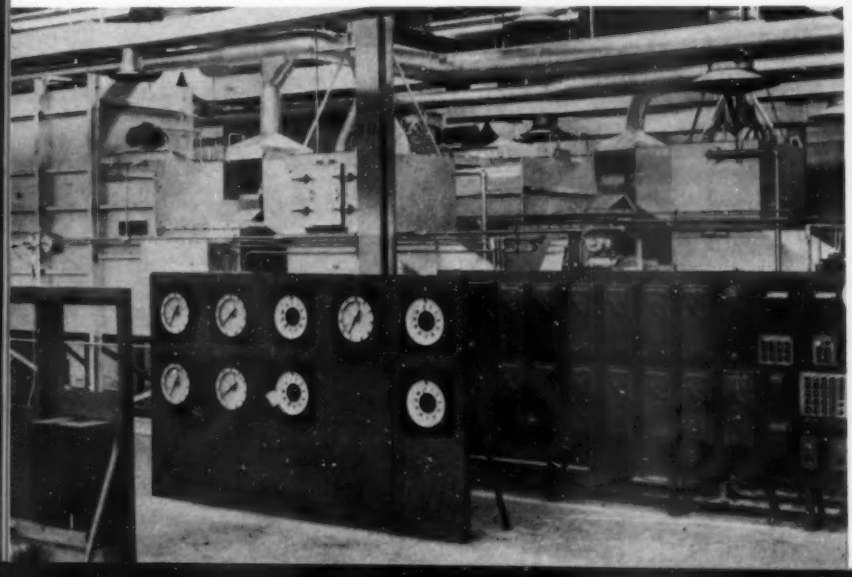
TOOLS at work

Economists are predicting that industrial production will turn sharply upward in 1959 and sweep to an unprecedented boom in the early 1960's. This optimistic outlook has been accepted as more than wishful thinking by a multitude of American manufacturers. In fact, industry across the country is busy readying itself for new production demands. This anticipation of upward trends is reflected in construction of new office buildings, new manufacturing plants and new facilities. Presented are only a few of many noteworthy examples of this expression of confidence.

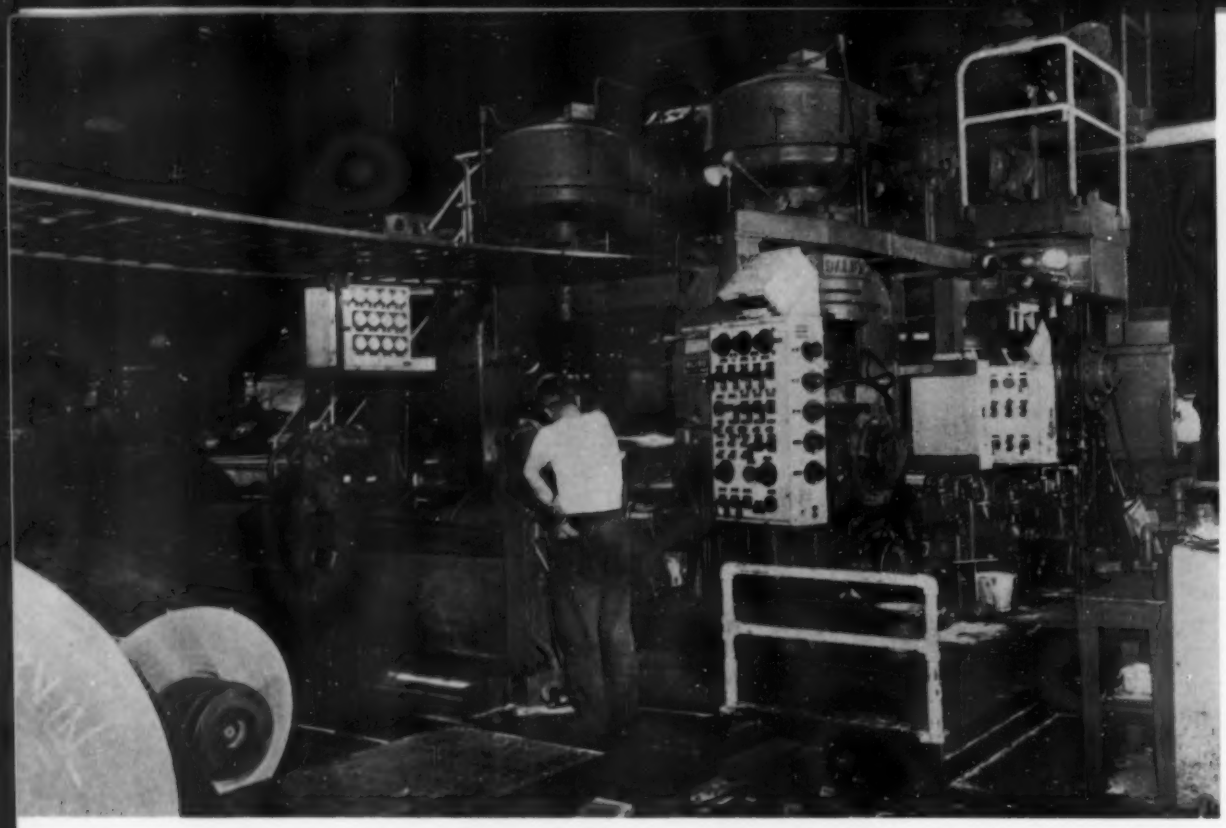


SPECIAL stacker crane is a feature of the new Allen plant. The crane is operated by one man, and can move freely down any aisle of the Christmas-tree racks and up and down to any level. It can handle bundles of stock up to 12 feet long, weighing up to 6000 pounds. The network of stacks is capable of holding more than 4,600,000 pounds of bar and rod stock.

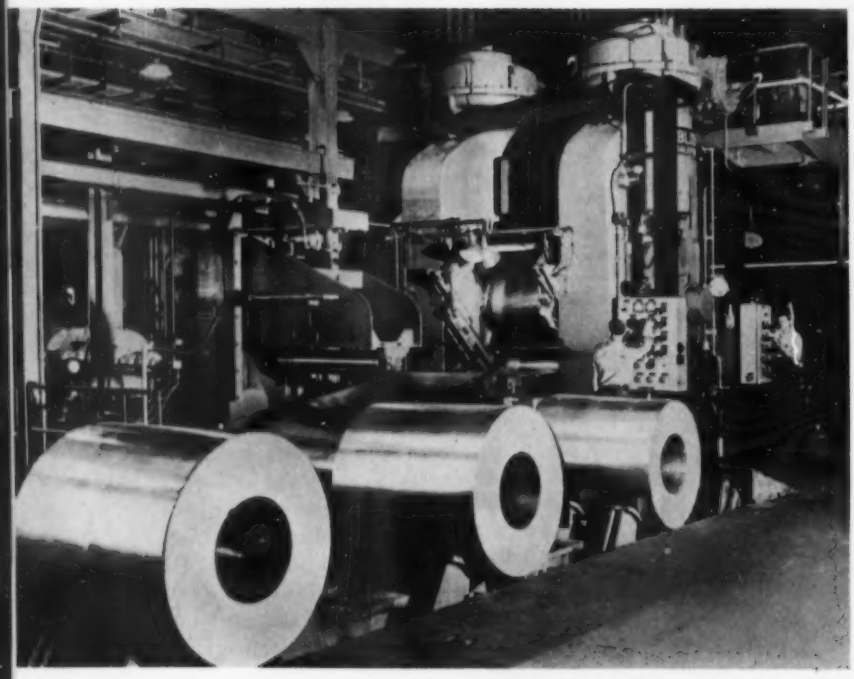
INDUSTRIAL washing machines clean all parts after each processing operation and before heat treating to remove abrasive material and contaminants. In the foreground at the right, is a vibrating dechipper which removes metal particles that may adhere to the products.



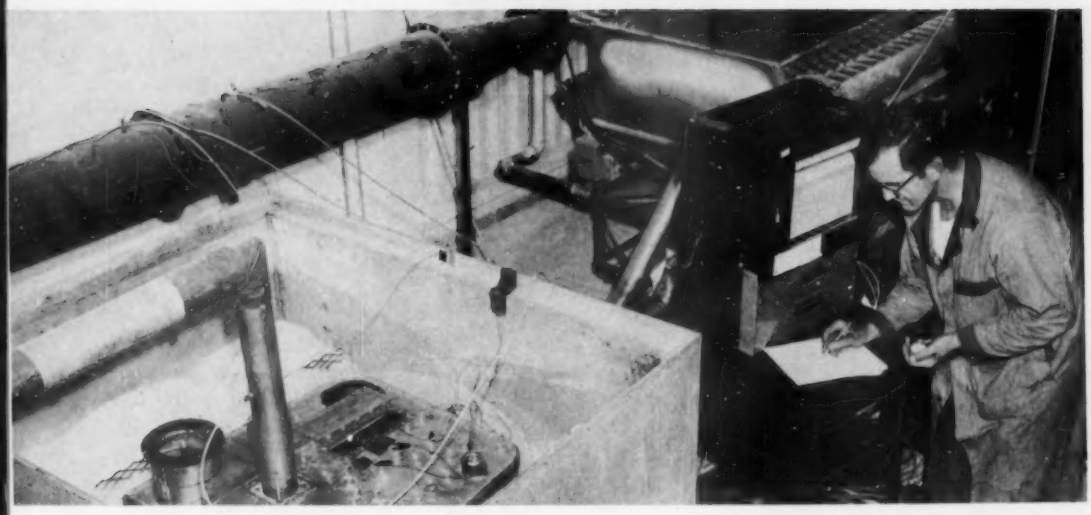
OPERATIONS of Holcroft heat-treating units are controlled by regulators which record processing data automatically. These units, designed for the new plant, harden, quench, wash and temper in a continuous operation.



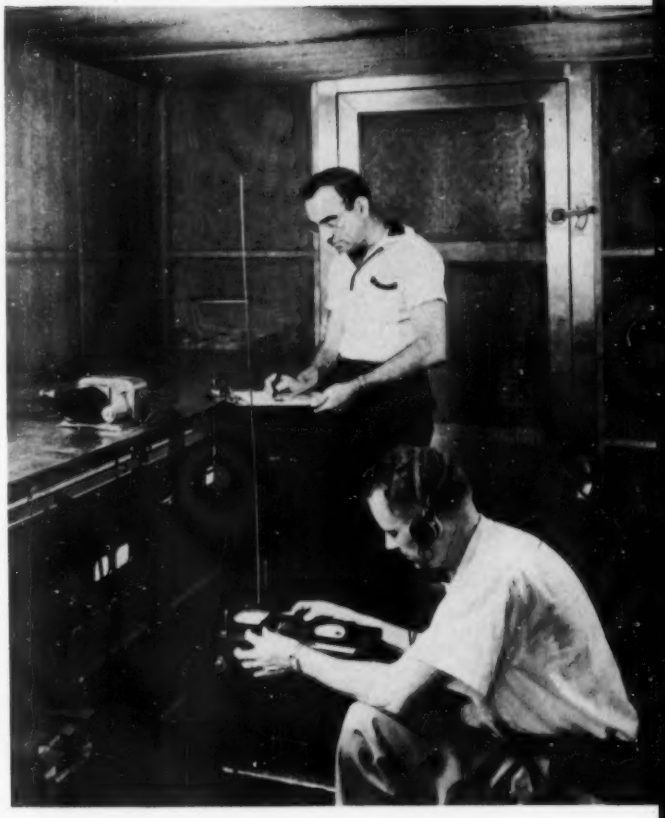
KEY INSTALLATION at Wierton Steel Co. is this E. W. Bliss Co., four-high, two-high tandem temper mill. Part of a multimillion-dollar expansion program, the mill rehardens strip prior to tin and zinc coating operations at speeds up to 6000 fpm. It can process steel strip in gages from 0.00435 to 0.0147 inch.



THIS FOUR-HIGH temper mill rolls high-carbon, high-phosphorous and deep-drawing steels. It can process as much as 1000 tons in a single day. Another installation: 48-inch slitting line processing galvanized steel in gages from 0.0135 to 0.135 inch at speeds from 200 to 1000 fpm.



AIR TO LIQUID HEAT EXCHANGER for a supersonic jet fighter undergoing test at Janitrol Aircraft Div. of Surface Combustion Corp. Test consists of 50 cycles of alternating freezing to 20 below zero and thawing with high-temperature air. Freezing is accomplished with a cold box packed with dry ice. This laboratory test area is part of a $2,500,000 plant recently put into production manufacturing components specifically for the aircraft industry.

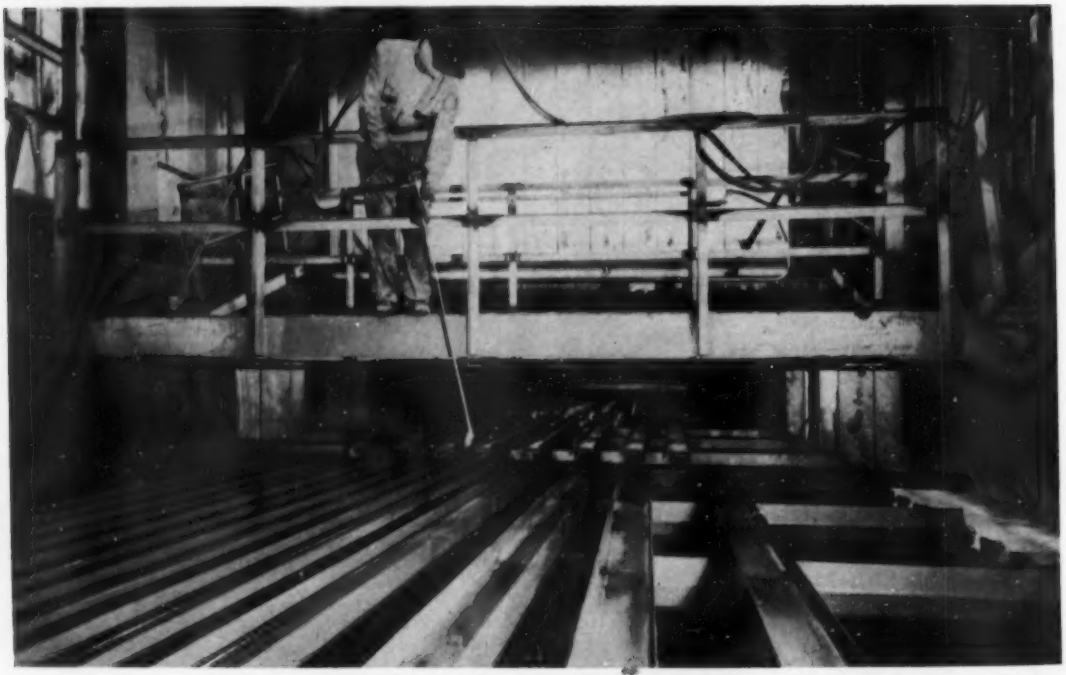


JANITROL ELECTRONICS engineers in a copper shielded room checking radio noise level of an ignition system. Noise emitted must be kept within rigid specifications to avoid interference with the radio communications of the airplane.

TOOLS at work

CONVEYORIZED spray unit, capable of processing over 200 tons of structural steel shapes each eight-hour day, transfers material to the storage and shipping yard as well as serves as a paint conveyor. The unit is 400 feet long and can process a 52-ton girder 130 feet long in about 30 minutes—about two and one-half hours less than conventional methods. Unit is at R. C. Mahon plant.

TOOLS at work



AS THE STEEL MOVES ON THE CONVEYOR, it passes two paint stations. On the overhead station, the operator stands on a catwalk, which can be raised or lowered by a pushbutton control. Steel is painted from below as it travels over an updraft pit spray station. Diamond-shaped cross bars support the girders and other steel products.

Fig. 1. Setup for measuring the accuracy of a template. As table is rotated, measurements are recorded by electronic amplifier.

measuring to millionths

with standard equipment

By **Lowell Elekman,** Supervisor
and
Mary Hoskins, Metrologist
The Eli Whitney Memorial Laboratory
The Sheffield Corp.
Dayton, Ohio

Many spherical and circular parts made today must be measured to six-figure accuracy. Conventional electronic gaging components and fixtures can be used for these measurements. A typical setup is described by the authors.

ACCURACY of machining operations is often dependent on the accuracy of cams and templates. The accuracy of the cams and templates is, of course, dependent upon the precision with which they are measured. While elaborate special gaging apparatus is sometimes employed for this purpose, it is possible to attain accuracies of millionths of an inch with an improvised setup. One such setup, *Fig.* 1, is used to measure a template having an arc of approximately 100 degrees with a four-inch radius.

The instrumentation consists of two Accutron amplifiers and an Electojet cartridge or pickup unit. One of the amplifiers is read visually; the other is of the recording type. The recording amplifier provides an automatic printed record of the template contour and also performs an important pregaging function by indicating when the setup has reached thermal stability. This is accomplished by recording thermal drift.

A standard height gage stand, fitted with an arm, holds the pickup unit in a horizontal plane. A Matrix rotary table on which the template is mounted completes the instrumentation. Circular positions of the table can be read three seconds of arc and table runout does not exceed 0.000025 inch. All components of the setup are mounted on a three by four-foot stone table in the metrology laboratory, where temperatures are within 0.1 degree of 68 F.

In making the setup, a reference button is secured to the face of the rotary table 3½ inches from the vertical axis of the table. Next, the template is lightly clamped to the table and its position adjusted so as to read zero on the Accutron scale at the 0, 45 and 90-degree positions. An amplifier having 20,000

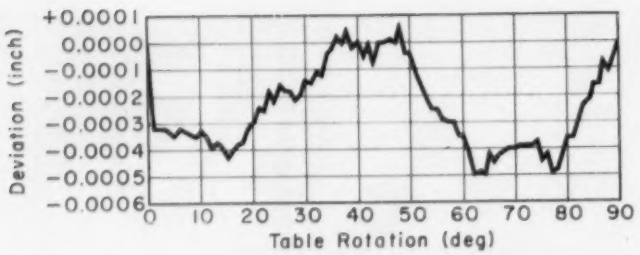


Fig. 2. Graph showing readings taken at each degree of rotation of table. This profile is plotted manually and is based on dial readings taken from an electronic amplifier.

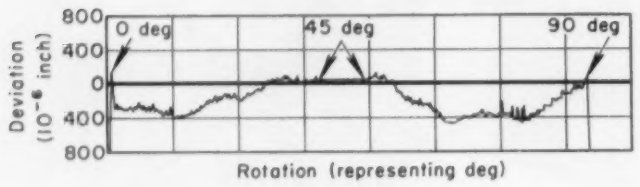


Fig. 3. Record made by recording amplifier serves as a check on manually plotted graph and shows exact profile of template as table is rotated. Each horizontal line represents 0.000040 inch. Straight profile at center of graph shows that table was stopped at 45 degrees.

to 1 amplification is used in positioning the template to assure precise location.

Template hold-down screws are then tightened and a full sweep of the template is made to determine whether probable radial variation will be more than ±0.0001 inch so that the proper measuring amplification can be selected. Where radial variation does not exceed ±0.0001 inch, a 20,000 to 1 amplification is used and where it is greater than this amount a 2000 to 1 amplification is selected.

In order to avoid picking up variations caused by surface roughness, the electronic gage tip approximates the form of a 10-inch radius. Reading the radii is simple. With the template secured and the proper amplification selected, the table is rotated until the reference button is opposite the electronic pickup unit. Gage blocks are inserted between the button and pickup unit until a zero reading is obtained on the Accutron meter. This establishes the true dimensional value of the radius

The table is rotated again to bring the template into gaging position at 0 degree. The table is then rotated in one degree increments through 90 degrees and the deviation reading from zero on the meter for each degree is plotted on polar coordinate paper *Fig.* 2. Readings are made within an accuracy of 0.000005 inch on high amplification and within 0.000025 inch on low amplification.

The full sweep trace of template contour shown in *Fig.* 3 was made by the amplifier recorder. The automatically recorded chart also serves as a check on the visual readings plotted on the polar coordinate paper.

Template inspection to the accuracy described enables repeated checks to be made on the same template at the same positions. As a result, it offers an excellent method of determining wear life or machine effect on various positions of a cam.

True roundness of cylindrical or spherical parts can also be determined by the same method. Such parts are positioned for true centrality by attaining zero readings at three measuring points.

Coining for Economy in Making Precision Parts

MACHINING is the conventional method to achieve the required close tolerances for inside diameter bead rings for air springs. However, Canton Malleable Iron Co., gained economically by using coining to produce the parts. The rings are sand cast of malleable iron in four to six sections. Inside diameter, face and most of the top sectional area are coined to produce parts so accurate that when the sections are assembled, the inside diameter of the ring is held within the specified tolerances of ±0.010 inch around the entire length of the bead. Distance from the mounting face to the underside of the bead is within ±0.0075 inch around entire length of the bead. When the size of the part is considered, the tolerances seem particularly close. Variations in temperature can substantially affect the dimensions.

Because it affords maximum ductility with high strength, malleable iron has been particularly suited to the application. Ductility is essential to insure coining to close tolerances. Innate strength, uniform quality and ductility of the material plus the company's experience in precision coining combined to net the saving in cost.

fabricating STAINLESS STEEL

Part Three—Joining

By Richard E. Paret
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American Iron and Steel Institute
New York, N. Y.

Joining stainless steel requires special techniques in order to preserve the properties that dictated its selection as a construction material. The author relates joining methods to each class of alloy. This article is third in a series covering all fabrication methods.

STAINLESS STEEL is usually specified for use when either high strength at elevated temperature or superior corrosion resistance is needed. Hence, care is required to insure that joints are neither weak nor points of corrosive attack and closely approach the properties of the basic structure.

Welding

This method provides maximum strength, and is preferred for joining stainless steel *Fig.* 1. If proper procedures are followed, corrosion resistance will not be materially impaired by welding temperatures. Welded joints are also easily blended for good appearance and finish.

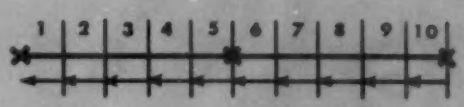
Austenitic grades provide highest weldability of the stainless steels, producing weldments which are extremely tough and ductile. They can be welded by all commercial fusion and resistance methods except forge welding. With the latter process a surface scale forms which is not soluble with any available flux and prevents fusion. The sulfur and selenium content of types 303 and 303Se tend to produce weld porosity, and these types should be welded only by the metal arc process, using lime-coated electrodes.

—Photo courtesy J. D. Ferry Co., Inc.

Fig. 1. Metal-arc welding operation performed on vent hood assembly of Type 430 stainless steel for potato frying machine. Welding with Type 308 filler rod provides improved toughness and ductility.

High-carbon grades, when heated or cooled through the sensitizing range—800 to 1650 F—are subject to carbide precipitation along grain boundaries. Chromium in the surrounding areas is depleted, reducing corrosion resistance. The effects of this condition may be critical when weldments cannot be annealed to redissolve precipitated carbides and are for use in corrosive environments.

SKIP WELDING



STEP-BACK WELDING

Fig. 2. Skip welding and step-back welding interrupt heat flow, reducing warpage. In skip welding, short equal-length bead sections are laid in sequence shown. When step-back welding each successive bead section is welded into the cooled end of the previous section. Joints should be tack welded prior to welding by either method.

Sensitization during welding can be reduced or avoided by using any of the low-carbon analyses (Types 304, 304L, 309S, 310S, 316L) or one of the stabilized grades (Types 321, 347, 348). The low-carbon types are used when relatively simple welding is involved and service will not be in the sensitizing range. The stabilized types are used for more critical applications, for more complex welding such as cross welding or where service will be in the sensitizing range.

The effects of low-heat conductivity and high coefficient of expansion of austentic grades require careful attention to control distortion. Copper chill bars, placed under weld areas to carry off heat and the use of welding fixtures will help to minimize distortion. Skip welding and back welding, *Fig.* 2, are used to control warpage by interrupting heat flow, thereby reducing the amount of heat concentrated in any one area. In skip welding, successively spaced sections of the joint are welded, and the skipped areas welded on the next pass. In step-back welding, a bead a few inches in length is laid down; then, moving ahead a distance equal to the length of this bead, a second bead is laid back to the first. In either case sections to be joined should first be tack welded in position.

Ferritic Steels: Distortion problems are greatly reduced when welding ferritic steels, since the rate of thermal expansion is close to that of carbon steel. Welded joints in these grades, however, tend to be less ductile than are welds made with the austentitic types. Ductility, especially in low-chromium steels such as Type 430, can be restored by annealing at approximately 1450 F, followed by fast cooling. At service temperatures of 200 F or more, however, these welds are quite ductile and tough and will provide satisfactory service. For room temperature applications, the best mechanical properties of ferritic steels are displayed by thin sections, where welding time is short.

Austentic electrodes, such as Type 308, 309 or 310 give good weld bead ductility and maximum toughness. However, they are not recommended where borderline corrosive conditions exist, or where extreme thermal changes in service are met, because the difference in coefficients of expansion of these grades produces stress.

—Photo courtesy Portland Copper & Tank Works, Inc.

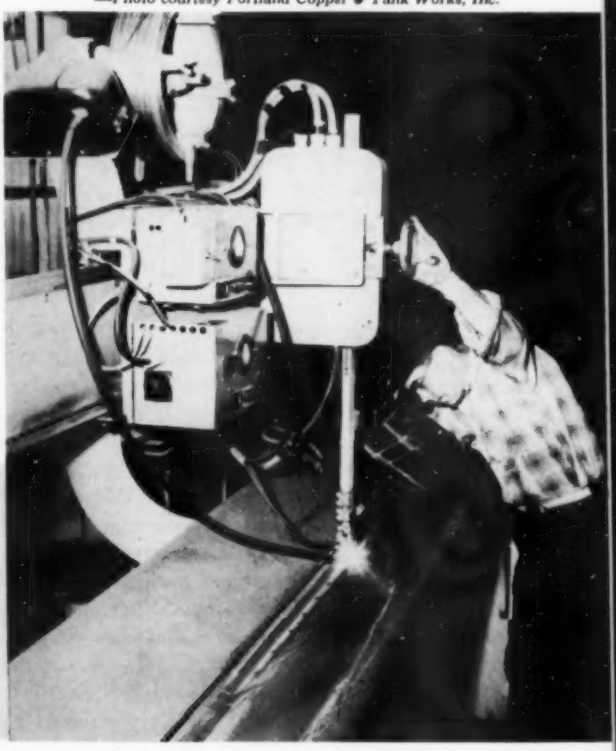


Fig. 3. Automatic inert-gas (argon) welding operation on a three-inch Type 316L, 14-gage stainless steel pipe for use in a paper mill. Longitudinal weld is made at travel of 18 to 20 ipm with Type 316L filler rod fed from reel. Provision is also made for channeling argon to underside of weld to prevent loss of alloy constituents.

Martensitic Steels: Since these steels are air hardening, hard, brittle martensite forms on cooling welding. If the material is preheated to approximately 500 F, and annealed immediately after welding, the danger of cracking is largely eliminated. The chromium content of filler rods should be at least equal to that of the base metal. Use of austenitic rods increases ductility, but prevents weldment hardening by heat treatment.

Low carbon martensitic steels, such as Types 403 and 410 offer good weldability and will not harden excessively on cooling. Types 416 and 416Se, because sulfur and selenium content promotes porosity, are not generally recommended for welding. Types 420, 440A, 440B and 440C, because of high carbon content, require extreme care to prevent cracking or embrittlement. Preheating to about 500 F and annealing immediately after welding will improve weldability of these types. Where assembly is necessary, applications for these steels usually do not require welding and mechanical fastening devices can be used.

Electric Arc Welding: This form of welding produces excellent results for 20- gage and heavier stainless steels. Short electrodes should be used because of the high electrical resistance of stainless, and reverse polarity (electrode positive) should be employed for better fusion and penetration. A portion of the elements in stainless steel electrodes—particularly chromium and columbium—are lost by oxidation in passing through the arc. Flux-coated electrodes will protect the molten metal from this form of alloy loss and help to produce a solid nonporous weld. Materials in the electrode coating provide additional elements to replace alloy loss in the weld and also form a fusible slag that protects the metal against excessive oxidation. This slag is not harmful and flakes away after the weld solidifies. In critical operations, however, a high-alloy electrode such as Type 308 is used.

Of all austenitic steels, Type 310 has a coefficient of expansion closest to that of the ferritic and martensitic steels. This type is usually preferred for welding rod when critical thermal changes in service are involved. Type 310 electrodes also provide maximum ductility and strength when welding ferritic and martensitic grades. The high alloy content of this filler wire also offsets dilution effects resulting from high-carbon contents.

Inert Gas Welding: This method is particularly recommended for thin gages of stainless steel. No flux is needed since welding is performed in a blanket of inert gas which shields the weld zone from oxide and other impurities, *Fig.* 3. Either argon or helium gas is used in conjunction with a nonconsumable tungsten electrode for light

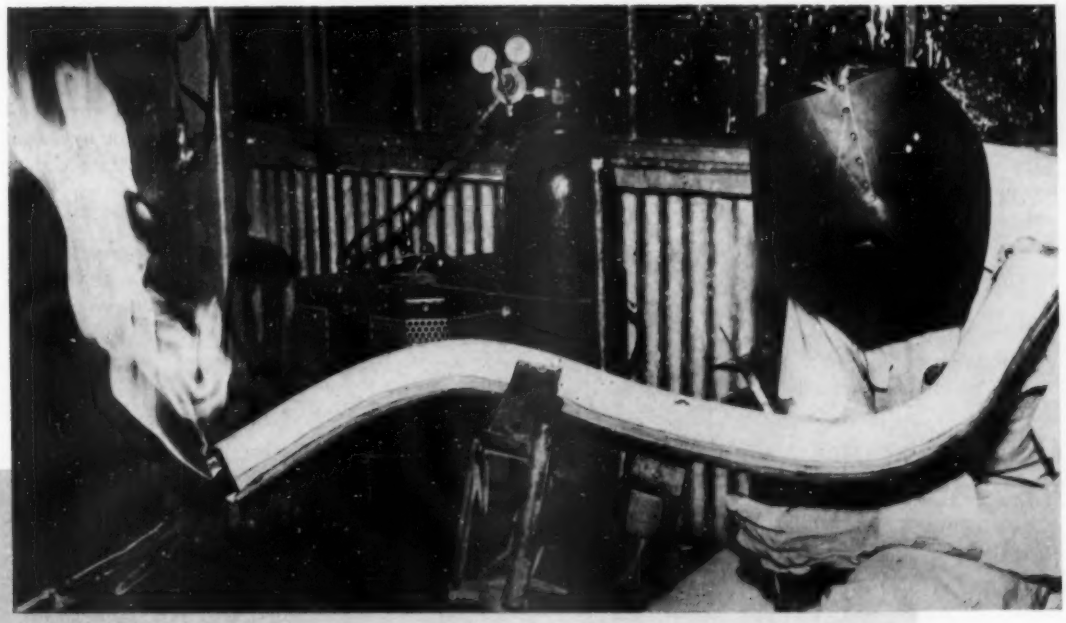


Fig. 4. Atomic-hydrogen welding of a long stainless steel tubular part. Introduction of illuminating gas into the tube maintains a reducing atmosphere on the underside of the weld. Flames from the burning gas are shown at the left.

Fig. 5. Oxyacetylene welding of a table top corner made from 18 gage Type 302 stainless steel. Thin gages are joined by this method.

—Photo courtesy Portland Copper & Tank Works, Inc.

Fig. 6. Spot welding a tailpipe liner fabricated from Type 321 stainless steel. Part, of 0.032-inch material, is corrugated prior to welding.

gages. The tungsten electrode eliminates carbon pickup and also permits higher welding currents, resulting in less distortion for thin sections. For sections over ¼ inch thick, a consumable electrode, with automatically fed filler material is used.

Since the inert gas shield prevents any appreciable alloy loss, filler rod, when used, can be of the same composition as the base metal. With Type 321 titanium-stabilized filler wire, for example, approximately 60 to 85 percent of the titanium content is transferred. This welding rod, therefore, produces more uniform corrosion-resistance and mechanical properties throughout the structure.

Submerged Arc Welding: When welding with a submerged arc the joint is protected by a mound of automatically deposited slag. The slag is melted by the heat of the arc and the arc is entirely submerged in this molten slag pool. An uncoated filler wire serves as the electrode.

This welding method is best suited to flat work. It can be applied to medium or heavy-gage work and can be done with either automatic or semiautomatic equipment. Adjustment to produce a proper arc length is important.

Atomic Hydrogen Welding: Intense heat is developed with this welding process in which a stream of hydrogen is passed through an alternating current arc between two tungsten electrodes, *Fig.* 4. Hydrogen is dissociated to an atomic state, absorbing energy, and is recombines to form molecular hydrogen and releases heat on striking the metal. This method produces a sound, smooth weld which can be ground and finished with a minimum of labor. No flux is necessary, and when joining thin gages of stainless steel by atomic hydrogen welding, no filler rod is needed. Proper clamping jigs and fixtures are required.

Oxyacetylene Gas Welding: Stainless steel sheet or strip 20 gage or thinner is extensively joined by this method, *Fig.* 5. Gas welding is slower than the electric arc method and a small flame should be used to prevent excessive warpage. Since it is difficult to maintain a neutral flame, a slight excess of acetylene is advisable to avoid an oxidizing flame, which may result in porous welds. Since a reducing flame protects the molten metal from the air, uncoated rods can be used. A special flux, mixed into a thin paste, can be obtained commercially for use on the unprotected underside of the joint, or on welding rod.

Filler rod is generally used for stainless steel 14 gage or heavier, and to prevent oxidation, should be kept in the flame. Skip and step-back welding methods in conjunction with welding jigs are recommended to avoid distortion.

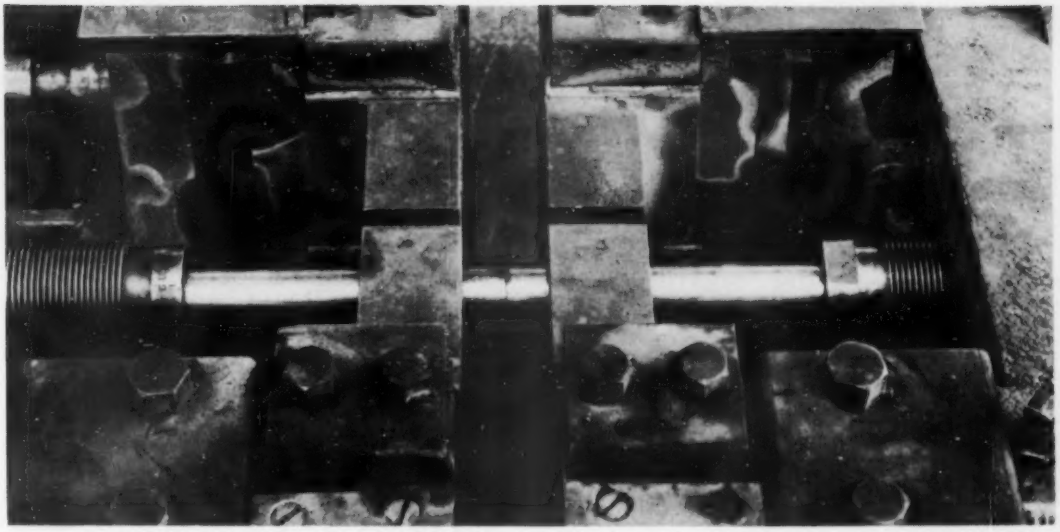


Fig. 7. Workpieces in machine before flash welding. Forging pressure is exerted through adjustable back-up stops. Clamps need only to transmit current and align work; they do not transmit pressure.

Spot Welding: Spot welding, *Fig.* 6, is the most popular form of resistance welding for joining lapped joints of light-gage stainless steel. The heat of fusion is produced by the electrical resistance of the steel to a current passed between two copper electrodes. This heat combined with the pressure of the electrodes forms a weld nugget between the sections being joined.

This method is especially effective for joining work-hardened structural members, without causing material reduction in tensile strength. The high electrical resistance of stainless steel also helps to minimize warpage, since heating is rapid and confined to a limited area.

Seam welding, a variation of the spot welding technique, uses roller electrodes to produce a series of continuous and intermittent welds on lapped joints. The position of the weld nuggets can be adjusted so as to overlap for pressure-tight seams, or to be more widely spaced for ordinary work.

Flash Welding: Flash welding is used extensively to join stainless bar and wire. The two edges to be joined are held in light contact and

Fig. 8. Flash, or molten metal, is extruded during upsetting action. The changed positions of the clamps from *Fig.* 8 show amount of material lost.

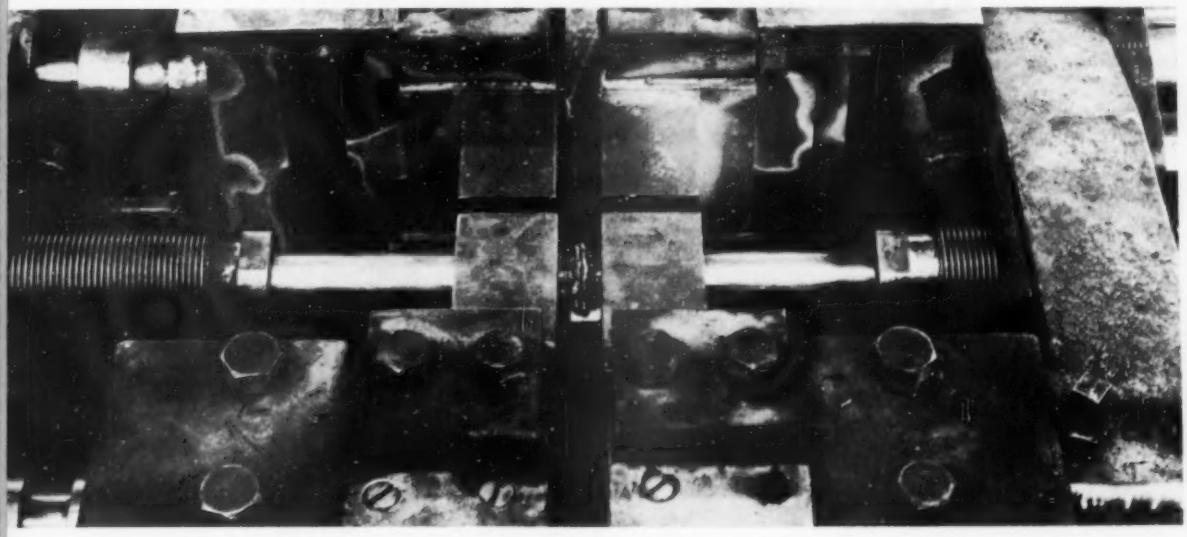


Fig. 9. Silver soldering a binding ring to a screen in a strainer for a carburetor scoop. Both parts are stainless steel. By rotating the work in the fixture, the flame covers entire circumference.

current passed through the workpieces, *Fig.* 7. Minute short circuits are produced and provide the heat necessary for fusion. When welding heat is reached, the current is turned off and the edges brought together under pressure. All metal in the molten state, as well as slag and other impurities, is squeezed out and form flash around the perimeter of the weld, *Fig.* 8. This flash covers the solid weld beneath, and can be easily ground or chipped off.

The edges of the workpieces to be joined must be square and accurately aligned to produce heating or flashing over the complete surface simultaneously. Workholding dies must also employ approximately 45 percent more pressure when joining stainless steel than is necessary for carbon steel, to prevent arcing.

Other Joining Methods

Because of the advancements in welding technique, riveting is seldom used as a joining method for stainless steel. Its application is generally restricted to assemblies where structural requirements make welding impractical.

To prevent galvanic corrosion, only stainless steel rivets should be used. Rivets up to ¼ inch in diameter of all types of stainless steel can be driven cold—preferably in one blow with a hydraulic riveter to prevent work hardening, and should be of the button-head type. Larger rivets, provided with cone type heads and driven hot, should be heated in muffle type furnaces with controlled atmosphere to prevent scaling. Austenitic types work harden rapidly, and must be driven at temperatures of 1800 F or higher. To prevent rapid grain growth and lowered ductility, ferritic steel rivets are driven in the 1400 to 1450 F range. Since martensitic types are air hardening, heating rivets above 1450 F may result in brittleness.

Soldering: The mechanical strength of a soldered joint is many times less than that of stainless steel and is subject to early failure if used to join stainless parts. Generally, soldering is recommended only as a seal for spot welded, riveted or other types of mechanically fastened joints.

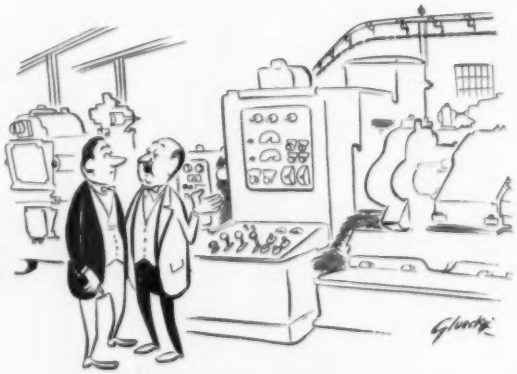
Either soft solder of the lead-tin variety, or silver solder can be used. Soft solder is suitable for mild corrosive conditions and good joints can be obtained with block tin or with a solder containing 70 percent tin and 30 percent lead. Generally, solders containing less than 60 percent tin will darken quickly on exposure to the atmosphere.

Silver soldering, *Fig.* 9, produces stronger joints than soft soldering and is the best method for joining stainless steel to nonferrous metals. Where service conditions are not too severe, hard solder also displays fairly good corrosion resistance.

Hard solders are generally alloys of silver, zinc or copper. Silver soldering, sometimes called brazing, is the only form of hard soldering recommended for stainless steel. The use of alloys containing zinc or copper may produce electrolytic action and reduce corrosion resistance.

Parts to be joined by silver soldering must be cleaned and preheated with an oxycetylene torch. Flux should be applied before the metal surface becomes oxidized. After soldering, excess flux can be removed with a jet of live steam or hot water.

The final phase of stainless steel fabrication—heat treating and finishing—will be discussed in a future article, the last in this series.



"This machine has the highest I.Q. of any in the plant."

ASTE news

Cecil E. Chapman

Robert M. Johnson

Stephen Pohlhammer

Dean Saurenman

Leslie C. Seager

Five Added to Director Slate

FIVE MEN have been added to the slate of candidates for the National Board of Directors, through petition of 20 or more members of the ASTE. This brings the list of nominees for the board to 21.

The 16 candidates selected by the Annual Nominating Committee were sketched last month in THE TOOL ENGINEER. The other nominees are:

Cecil E. Chapman, now completing his first term as a director, is superintendent of the rail accessories department at the Inland Steel Co., East Chicago, Ind. He is a past chairman of the Indiana Council of ASTE chapters and also of his own chapter, Calumet Area, which he was instrumental in forming. He is now serving on the steering committee of the ASTE Research Fund metal stamping project. Also a past chairman of the Calumet chapter of the American Society for Metals, Chapman helped obtain a charter for the ASM unit. His record includes membership on various technical committees for the American Iron and Steel Institute and the American Railway Engineering Association. With a background in metallurgy, tooling and supervision of manufacturing practices, Chapman has authored a number of technical papers.

Robert M. Johnson, production engineering supervisor at Minneapolis-Honeywell, has been a member of the national membership committee since 1956. Service in various offices of Twin Cities chapter beginning in 1947 led to the chapter chairmanship in 1954-55. He was a national delegate for two years. During 14 years at Minneapolis-Honeywell, Johnson has been a tool designer, plant layout engineer, and process engineer, as well as a production engineering supervisor first in the firm's assembly division and currently in the manufacturing division. He is a reserve officer in the Navy Air Force and belongs to various civic groups.

Stephen Pohlhammer, president of Northwest Tool and Engineering and also of Wisconsin Drill Head Co., both of Milwaukee, has been a member of the Milwaukee ASTE chapter since 1945. He has served his chapter as a national delegate, chairman, first and second vice chairman, secretary, treasurer, chairman of program committee, and member of the education and nominating committees. Currently he is acting as Division "A" coordinator of the 1959 national convention host committee. Pohlhammer is past president and present trustee of the National Tool, Die and Machine Shop Association, Milwaukee chapter.

Dean Saurenman, member of Houston chapter since 1940, is associate development project engineer for the Schlumberger Well Surveying Co. He has held all chapter offices except secretary up to and including chapter chairman. In addition, he has served a year on the national editorial committee and three years on the national standards committee. He was chapter subchairman for the 1957 ASTE convention in Houston and was chairman of the plant tour committee for the national convention in Houston in 1947. A graduate of California Institute of Technology, Saurenman is also affiliated with the ASM and the American Petroleum Institute.

Leslie C. Seager, in his third year as national director, is chief production engineer for Eimco Corp., Salt Lake City, Utah. He served four years on the national professional engineering committee, one year as chairman. Instrumental in organizing Salt Lake City chapter in 1950, he served two terms as its chairman and has held other chapter offices through the years. Seager helped to establish four-year tool engineering curricula at Westminster College and Utah State University. A leader in the Utah Engineering Council, he has long worked to coordinate engineering education with the needs of industry. He is affiliated with the American Ordnance Association and the Institution of Production Engineers in Britain.

Award of Merit
Winners Named

Edward J. Berry
Homer Briggs
Arthur Cervenka
Edward Willard Dickett
Willard R. Frazer
Harold W. Hagle
Earl Victor Johnson
John W. Lengbridge
J. Don Reep
Rudolph Regen
Glen Roberts
H. Wilson Ryno
Michael Skunda
Robert J. Wilson, Jr.

FOURTEEN MEN, nominated by their own chapters, will be presented with Award of Merit plaques in recognition of their steadfast aid to the Society. By unusual effort and dedication in service to their chapters, by countless hours spent working on committees, both national and local, and by contributing to the Society's greater recognition and prestige with industry, the recipients have made themselves known and eligible.

Frank W. Curtis, chairman of the national honor awards committee, in summing up the importance of the merit awards, said, "The entire Society may well be proud of the 1959 roster of recipients. It is upon men of this caliber that ASTE must depend for its continued and increased stature."

The chapter-level awards were instituted last year. Presentations are made at chapter meetings.

The award winners are:

EDWARD J. BERRY, Little Rhody—As the motivating force in his chapter's chartering he served as first chairman and on all chapter committee posts. Working on the national constitution and by-laws and the standard committees, he was at the same

Edward J. Berry

Homer Briggs

Arthur Cervenka

Edward Willard Dickett

William R. Frazer

Harold W. Hagle

time a prime mover in fostering a regional conference of the New England ASTE chapters. Through personal contact or the press he promoted the ASTE and its story whenever possible to industry and potential members. Home: Englewood, Fla.

HOMER BRIGGS, Houston—His activity on education committees resulted in Houston on-campus conferences in 1954 and 1956. He also conducted tool design courses at the local college. Having filled all chapter elective offices, Briggs exerted his efforts in 1953 and 1954 toward gaining state registration of professional engineers. Home: Houston, Texas. Position: tool engineer, Reed Roller Bit Co.

ARTHUR CERVENKA, Long Island—For his efforts as the man behind its chartering, Cervenka was chosen as the Long Island chapter's first chairman. Credited with aiding greatly in staging the Greater New York Tool Engineers Day, he also organized a student group in the area. Serving on two national committees and aiding Heaquarters books and editorial activities account for a few more of his numerous achievements. Home: Oakdale, L. I. Position: chief engineer, Grumman Aircraft.

EDWARD WILLARD DICKETT, Rockford—Following his organization and past chairmanship of Chapter #12, Dickett devoted 16 years of service to the chapter's directory committee. He also lent a hand in the formation of seven other ASTE chapters. The *Tool Engineers Handbook* lists him among its authors. Home: Rockford, Ill. Position: sales engineer, Sundstrand Machine Tool Co.

WILLIAM R. FRAZER, Northern Massachusetts—The principal credit for the formation of Chapter #100 goes to this man. Financial support and continued assistance from industries throughout the state have been secured by Dr. Frazer, who has traveled extensively, always carrying the ASTE message with him. He is always available to anyone seeking advice or assistance. Home: Athol, Mass. Position: chief metallurgist, Union Twist Drill Co.

HAROLD W. HAGLE, Erie—His interest in youth accounts for Hagle's promotion of vocational guidance in high schools and other youth-building programs. This past chairman added greatly to the Society's prestige when he presented a talk on "Engineering as a Career" on a local radio station. The education, program and nominating committees have all made use of his services. He also served three years on the national editorial committee. Home: Wesleyville, Pa. Position: assistant to owner, Kerner Tool & Die Co, Erie.

EARL VICTOR JOHNSON, Dayton—Not only was he the organizer and first chairman of his own chapter, but Johnson took part in the formation of five others besides. His activities include service as

Earl Victor Johnson

John W. Lengbridge

J. Don Reep

Rudolph Regen

regional director and on numerous committees, installation of tool engineering courses in local colleges, and participation in youth-building and other community interests. Home: Dayton, Ohio. Position: president, Dayton Carbide Tool Co., Inc.

JOHN W. LENGBRIDGE, Toronto—Education responsibilities have proven this past chairman's forte. Instituting chapter scholarships and setting up and teaching tool engineering courses are among his accomplishments. The Headquarters editorial and book departments have also benefited from his aid. During Lengbridge's term as chairman, membership increased rapidly. Home: Toronto, Ont., Canada. Position: project engineer, Aluminum Goods Ltd.

J. DON REEP, Buffalo-Niagara Frontier—As the founder of his own, plus five other chapters of ASTE, Reep still found time to serve as a national director for the Society. He was chairman of the national standards committee for two years. His term as original chairman of the chapter also helped to qualify him as a Merit Award winner. Home: Buffalo. Position: president, Machinists Tools.

RUDOLPH REGEN, San Fernando Valley—The Los Angeles and the San Fernando Valley chapters have both seen Regen in action. He has headed numerous committees in both organizations and was cofounder and one-time chairman of San Fernando Valley. Seeking collaboration between ASTE chapters in that area, he helped organize the Southern California Council of ASTE chapters. Promotion of student interest in tool engineering was another of his activities. Home: Sherman Oaks, Calif. Position: chief tool engineer, General Machine Works, Inc.

GLEN ROBERTS, Twin Cities—The program, public relations, education, and membership committees of this chapter have all been headed by Roberts at one time or another. During the latter chairmanship, a rapid growth in chapter membership was noted and most of the recognition went to the chairman. This past chapter chairman had done outstanding work in increasing the Society's prestige and strengthening its reputation throughout the Minneapolis-St. Paul area. Home: Minneapolis, Minn. Position: president, Roberts Automatic Products, Inc.

H. WILSON RYNO, Northern New Jersey—Serving his chapter in both elective and appointive offices, Ryno is one of the charter members. Also a past chairman, he inspires other chapter members by his never-failing attendance at all meetings, executive and technical. More than the usual amount of time and effort has been devoted by him to making Chapter #14 an outstanding success. Home: Essex Fells, N.J. Position: owner, H. Wilson Ryno Co.

MICHAEL SKUNDA, Saginaw Valley—By organizing what was originally the Flint chapter, Skunda was rewarded for his enthusiasm by being elected the charter chairman. He has served on more than a few committees of this chapter, the title of which was eventually changed to Saginaw Valley. His most outstanding work was done on its standards committee. Activities as an instructor in engineering courses have also distinguished him. Home: Davison, Mich. Position: supervisor of production engineering, A. C. Spark Plug Div., GMC.

ROBERT J. WILSON, JR., Chautauqua-Warren—His affiliations and activities with other technical societies have contributed greatly to ASTE prestige throughout the country. He has served as chairman of the Erie chapter and, too, his present chapter of which he was co-organizer. His time away from chapter and job is chiefly spent in promoting community health movements. Home: Warren, Pa. Position: engineer in charge of plastic mold design, Sylvania Electric Products, Inc.

Glen Roberts

H. Wilson Ryno

Michael Skunda

Robert J. Wilson, Jr.

A Look At

IT WON'T HELP bring about more economical machining operations; it has nothing whatsoever to do with the march toward automation—nonetheless, the chapter bulletin is one of the most vital "tools" ever designed by the tool engineer.

Nothing connected with ASTE is nearer the heart of the member than his bulletin. His feelings about it are seldom halfway: he regards it as either a boon or a bane, as something to be proud of or, if he works on it, as a pain in the neck. And almost invariably, when he discusses it, he talks in metaphors.

For instance, one past chairman (who was just as proud of the fact that he was also a past bulletin editor) had this to say:

"A chapter and its bulletin go together, if not like love and marriage, at least like a horse and carriage. And a *good* bulletin can be a real workhorse and really pull its load."

When the national republic relations committee recently prepared a study of the "Typical ASTE Chapter Bulletin," Chairman George C. Bennett prefaced the survey with these words:

"As important to the chapter as a clean collar and manicure to the salesman, the bulletin is the billboard of chapter activities, the chapter's ambassador to the uninitiated, and a many-mirrored reflection of the chapter membership."

'Mother Bulletin' Feels Kinship

In spite of the fact that chapter bulletins are procedurally under the jurisdiction of public relations, and not editorial, THE TOOL ENGINEER feels a certain proprietary kinship with them. Like a mother and stepchildren, perhaps. Or like love and marriage—for ideally the national and chapter issues supplement and complement each other.

At any rate, the national magazine feels justified by this kinship, and qualified by virtue of its position as the "mother bulletin," to take a critical look at what is good and what could be better about the 140-odd bulletins that each month join it in "disseminating scientific knowledge" and keeping the member abreast of the ASTE.

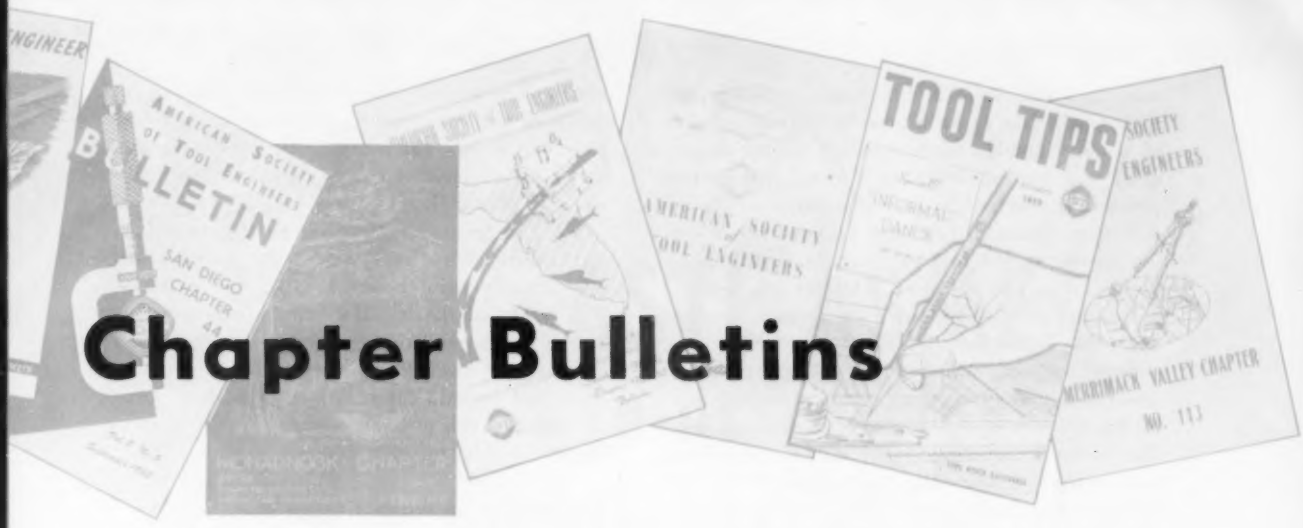
In the hands of a conscientious public relations chairman, the bulletin is second to nothing else in gaining public recognition for the chapter. If well-planned and informative, it can encourage potential members to investigate the Society, and it may even revitalize old members who have been neglecting their duties. Also, it can carry the chapter's message to local industry—and perhaps even influence local industries to buy some advertising space. . . .

What Makes It Possible

To begin at the beginning, in other words, the thing which makes the bulletin possible is advertising revenue. Without the funds supplied by local advertisers, the chapter bulletin could not exist. Many chapters have taken public note of this by staging annual "Advertisers' Nights" for their bulletin patrons.

Unfortunately the advertising situation is the aspect of bulletin publishing that seems most apt to get out of hand. While the ideal reason-for-being of a bulletin is simply to serve the chapter membership, in some cases the prime motivation for the chapter publishing venture would seem to be profit. Certain bulletins contain little more than ads—even some of the "editorial matter" is commercially inspired plugs for advertisers or potential advertisers.

A spot check by THE TOOL ENGINEER staff of one month's bulletins from 130-odd Society Chapter found that 48 percent of the 1340 printed pages represented were devoted to advertising. That's not an



Chapter Bulletins

alarming percentage if it could be applied to each of the bulletins, but it is an average. One bulletin had 92 percent advertising—graciously allocating eight percent of its space for an announcement of the coming meeting.

No Dearth of Editorial Material

The "typical" bulletin, however, recognizes that the tool engineer can read. It carries technical articles, Headquarters releases, messages from the chairman and other chapter officials, reports of past meetings and announcements of coming meetings, and reprints of items from *Scope*. There's no dearth of editorial material.

Occasionally one finds an interesting approach. The bulletin from the recently chartered Santa Monica Bay Area chapter, for example, suggested that articles describing the activities of local industries be authored by members representing the firms. A member's company will be chosen, by lot, each month; if the "lucky" company employs more than 10,000 people, it will be disqualified as the subject of an article because the bulletin hopes to avoid using material that is already generally known. Not only is such an appeal for member contributions a boon to small businesses, but it also constitutes a source of fresh, significant material for the editor saddled with a so-so bulletin.

Another idea, too seldom employed, is to tie in a coming meeting with a forthcoming article in THE TOOL ENGINEER. An editor on his toes can capitalize on a scheduled technical meeting on thread rolling, say, when he notices that there's an article on internal thread rolling in the current issue of the national magazine. He can point out to the members that the article will supplement the lecture, or the lecture will be background for the article. If the bulletin editor reads *Scope*, by the way, he knows in advance what the magazine will carry, for a monthly "Editor's Memorandum" in *Scope* summarizes the contents of THE TOOL ENGINEER preceding publication date.

In sizing up the ASTE bulletins, one notably weak spot appeared. Of all the bulletins surveyed, only three percent of total content—including advertising—was devoted to coverage of past chapter activities. It would seem only fitting to tell the member who wasn't there just what happened at the last meeting, but it's the rare bulletin editor who does. The general philosophy seems to be that what's past is past.

Perhaps the outstanding characteristic of a good bulletin is dignity. Lack of it is in turn the most inexcusable attribute of a bad bulletin. The aim of the ASTE and of its organizational units, the chapters, is to advance scientific knowledge in the field of tool engineering. The bulletin editor should use that precept as a touchstone in all his decisions as to what goes in his bulletin; anything that doesn't pass the test should be suspect. It isn't necessary that the chapter bulletin positively reek of dignity—it may not get read if it does—but it can be lively and interesting without resorting to cheesecake, bad jokes, gossip, and unadulterated sales pitches.

Tell a Book by Its Cover

A discussion of what appears on the pages of a chapter bulletin must eventually lead to what binds these pages together, that is, the cover.

In the case of ASTE chapter bulletins you *can* tell a book by its cover. Those booklets with attractive cover pages usually carry this over into the interior.

Elaborate art work is not necessary for excellence. One of the best looking covers, in fact, simply fea-

tures the letters ASTE and the name of the chapter. Although it fails to fill all the NPRC requirements of a good bulletin cover (Society name, chapter name and number, date), the "front" this chapter presents is effective because of its very simplicity.

Another chapter, Southeast Florida, ran a contest among its members to select the most colorful design for its bulletin cover. This not only resulted in an interesting cover, but it also inspired interest and pride in the bulletin.

Some bulletins have both the proper amount of advertising and an adequate supply of reading matter but still lack appeal because of ineffective layout. The reader is sometimes faced with a mass of ads unattractively and unstrategically arranged, or copy which seems literally crammed into niches and crannies of the pages. Balancing advertising and editorial content on every page with a sprinkling of photographs is the best answer in the quest for a good chapter bulletin. Careless, hurried layout denotes an overworked or a too-busy-to-care bulletin editor. In either case the chapter can only benefit by the addition of a few capable and *interested* members to its bulletin staff.

As far as frequency of publication, size, printing, circulation, and distribution go, these depend on the size of the chapter. Some chapters distribute as many as 3500 bulletins while others send out fewer than 250. More important than the amount of circulation is to whom the booklets are sent. Naturally each member should receive a copy. The national officers, educators, other technical societies, advertisers, prospective members, ASTE Headquarters, and other chapters are usually included on the mailing list. One ingenious chapter sends copies to one-third of the chapters each month, rotating the thirds so that each chapter gets a quarterly report from this group. This chapter has such confidence in its bulletin that it wishes to share it with the whole ASTE.

Many things go into the makings of a good chapter bulletin. What these things are and whether they actually exist, however, are different stories. The results of the NPRC's bulletin survey report and its current bulletin-improvement program show that in most cases they do exist, and where they do not the bulletin editor is making haste to bring them about. This program seems to be just what the Society ordered for its ailing chapter bulletins.

Responsibility of Whole Chapter

The chapter bulletin is a chapter project. True, the responsibilities involved in putting it out every month rest on the shoulders of only a few members, but it is certain any ideas for improvement or contributions on the part of other members would not be scorned. The bulletin represents the entire chapter in the eyes of the community. And only with the entire chapter supporting this undertaking can the public gain a proper perspective.

A worthwhile bulletin, one with something to say, can increase the prestige of the chapter in the community, publicize the activities of the chapter membership, make known the high standards which govern the Society, and even surpass the boundaries of the community by achieving wide attention for those who belong to the Society and who strive to make it the outstanding professional group that it is.

Composite Picture of a Bulletin

Here is a kaleidoscope of Average Valley Chapter No. 00's bulletin. These are in substance the statistics arrived at by compiling figures from all ASTE chapters who cooperated in the national public relations committee survey last year. This composite picture is of a "typical" and not necessarily an "ideal" bulletin.

In appearance—the chapter bulletin is a five-inch by eight-inch booklet with colored cover, containing from one to twelve pages, carrying some photographs.

In mechanics—it is printed on letterpress, 10 times a year. Layout is by an editor whose staff of one or two men prepares for publication chapter news, technical articles, Headquarters releases, a monthly message from the chairman, national news and items reprinted from *Scope*.

In circulation—488 copies addressed by stencil list go out four to seven days before monthly meetings to: members, educators, local executives, advertisers, national officers, and ASTE headquarters.

In financial matters—it costs less than $150 per issue to publish, makes a profit (deposited in the chapter's general fund) from its advertising, charging an average $100 to $150 per year for a full-page ad. No more than two persons sell ad space, and they receive no commission.

ASTE-ASME joint session highlights Milwaukee technical program

THREE PAPERS by members of the American Society of Mechanical Engineers will be among 27 technical papers to be presented at the ASTE's 27th Annual Meeting in Milwaukee.

The joint ASTE-ASME session marks an important first for the Society and illustrates the growing spirit of cooperation among the ASTE, the ASME, and other technical organizations. Scheduled at 3 p.m., Tuesday, April 21, the special session will be held at the Schroeder Hotel, like all the other meetings at the ASTE's convention.

J. R. Brand, of the meetings committee of ASME's Machine Design Division, will chairman the session. The papers will be "Developing Creativity in Engineering" by D. G. Taylor, staff engineer, Minneapolis-Honeywell Regulator Co., and Richard C. Jordan, head of the mechanical engineering department of the University of Minnesota; "The Human Factors Responsibilities of Design Engineers" by Joseph L. Seminara, human factors specialist at Feltman Research & Engineering Laboratories, Picatinny Arsenal, Dover, N. J., and G. A. Peters, consultant, Santa Monica, Calif.; and "The Potential Machine Designer" by J. F. Downie Smith, vice president-research and development, Carrier Corp., Syracuse, N. Y.

The ASTE role in the exchange agreement was worked out last year by a committee composed of Vice Presidents H. Dale Long and William Moreland and National Treasurer Philip R. Marsilius. First fruit of the arrangement was a joint session held in New York last December as a part of the ASME's annual meeting, when one ASTE paper by A. P. Mazzurchelli, and one by E. J. Weiter and A. O. Schmidt were presented. Exchange papers are selected not only on the basis of their technical excellence, but also for their interest to *both* societies.

'Planning for Profit' Seminar

Another highlight of the Milwaukee technical program will be the eleven-paper, five-session seminar on "Planning for Profit." Cost will be $50 for ASTE members, $75 for nonmembers.

The seminar's title is also the theme for the convention.

Carl S. Abbott, member of the national program committee and president of J. N. Fauver Co., Detroit, will serve as general chairman. The seminar will begin at 9 a.m. Monday, April 20, with an introductory analysis by Theodore W. Black, senior associate editor of THE TOOL ENGINEER, and conclude Tuesday afternoon with a panel discussion and a recapitulation by George H. DeGroat, author of the ASTE's recently published book, *Tooling for Metal Powder Parts*, and associate editor of *American Machinist* magazine.

Designed to appeal to the tool engineer in the management classification, the "Planning for Profit" seminar will cover such subjects as control of overhead costs, factors affecting capital costs, research and development cost control, control of materials costs, cost control in quantity production and in job shops, and control of labor and management costs.

One of the papers, for example, on "Control of Research and Development Costs," will highlight the importance of R&D to the sales and profits of some of the nation's leading manufacturing firms.

To be presented by ASTE Vice President Long, who is president and board chairman of Scully-Jones & Co., it will detail the controls used by a manufacturer from the consideration and authorization of a project down through the routine steps of patent search, surveys, research, development, prototypes, tests, pilot runs, production, and distribution.

Seven Other Sessions Slated

Further effort to recognize the tool engineer's growing concern with management problems will be a two-paper session entitled just that: "Tool Engineers and Management." Papers will be "When Does an Engineer Become a Manager?" and "For Better Understanding—of Your Business by Your People."

Other sessions will treat the tool engineering profession as it relates to education, statistics, metal cutting, shop operations, machine tools, and, finally, new developments.

Random exploration of the technical paper offerings uncovers intriguing titles ranging from "Zero Point One"—a report by Albert M. Dexter, director of metrology for Pratt & Whitney, on progress toward splitting an inch into ten million parts—to "Design Problems with Precision Elephant Type Machine Tools" by Walter L. McCann, chief engineer of the Giddings & Lewis Machine Tool Co.

Authors are scheduled from as far afield as Denmark. Ivar Bendixen of Copenhagen's Technical University is due to present a paper on "Power Measurements in Milling," but Research Engineer J. R. Roubik of Kearney & Trecker Corp. is standing by to read Bendixen's paper in case the author cannot make the trip to Milwaukee.

Copies of all the papers will be available individually as well as in collected form. In addition, the "Planning for Profit" papers will be offered as a group.

The complete convention program will appear in next month's issue of THE TOOL ENGINEER.

Bergstrom is Whitney Lecturer

Swan E. Bergstrom

SWAN E. BERGSTROM, newly named president of The Cincinnati Milling Machine Co., has been chosen to deliver the third annual Eli Whitney Memorial lecture at the Milwaukee convention. He will speak on "The History of Metal Cutting" at the Honor Awards dinner Saturday evening, April 18.

Bergstrom, who is on the ASTE's Research Fund Committee, and is president of Cincinnati Milling Machine Co., was chosen as the man who best emulates the spirit of Whitney, founder of modern tool engineering and pioneer of U.S. mass production.

In addition to the Whitney citation, six national Honor Awards will be given out at the dinner. Selections of the recipients are made by the national honor awards committee chairmanned by Frank W. Curtis. The awards are:

Gold Medal—for outstanding service through published writings or papers dealing with tool engineering.

Research Medal—for significant published research on materials, facilities, principles, and operations, and their application.

Engineering Citation—for unusual skill by an ASTE member in the development of tool engineering principles.

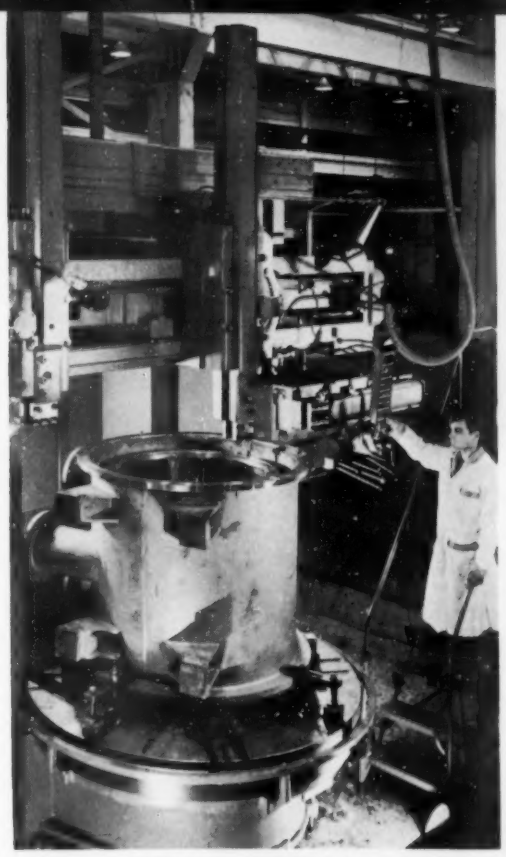
Education Award—for developing dynamic curricula and sound training methods, or inspiring students to enter on tool engineering careers.

Progress Award—for accomplishments in manufacturing processes, methods, or management.

Joseph A. Siegel Memorial Award—for contributions through leadership, voluntary support, or other acts of benefit to the Society; perpetuated by past presidents in memory of the ASTE's charter president.

Both Society members and nonmembers are eligible for all except the Siegel Memorial and Engineering awards, which are restricted to members.

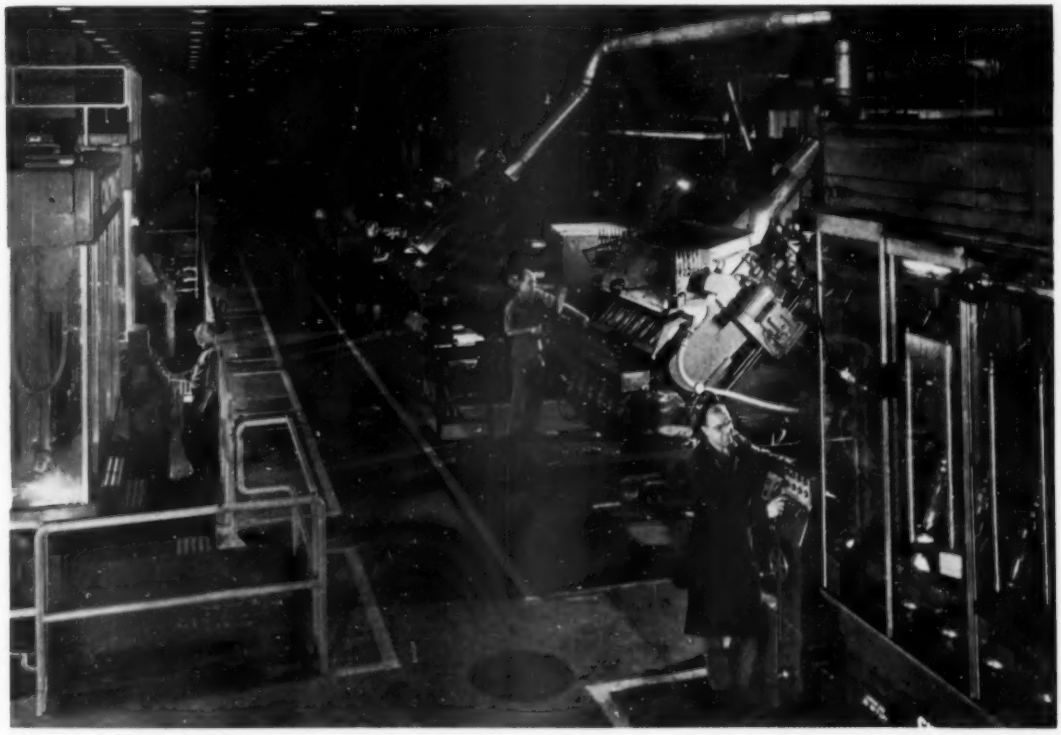
Inside Milwaukee's Plants



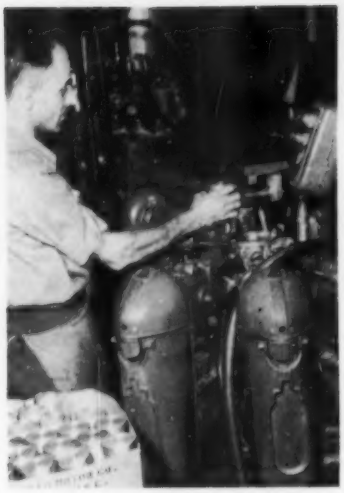
Large stator housing is turned and bored in a vertical turret lathe at the Louis Allis Co.

ELEVEN TOURS of seven manufacturing facilities in Milwaukee—often described as "the machine shop of America"—are scheduled April 20 to 22 for delegates and visitors at the ASTE's 27th Annual Meeting. The plants, together with their processes and products, exemplify the theme of the convention, "Planning for Profit."

Other firms on the tour list, in addition to those depicted here, include Harnischfeger Corp., A. O. Smith Corp., and The Falk Corp. A complete timetable of the tours, and briefings on what will be seen, will appear in the convention program and in next month's issue of THE TOOL ENGINEER.

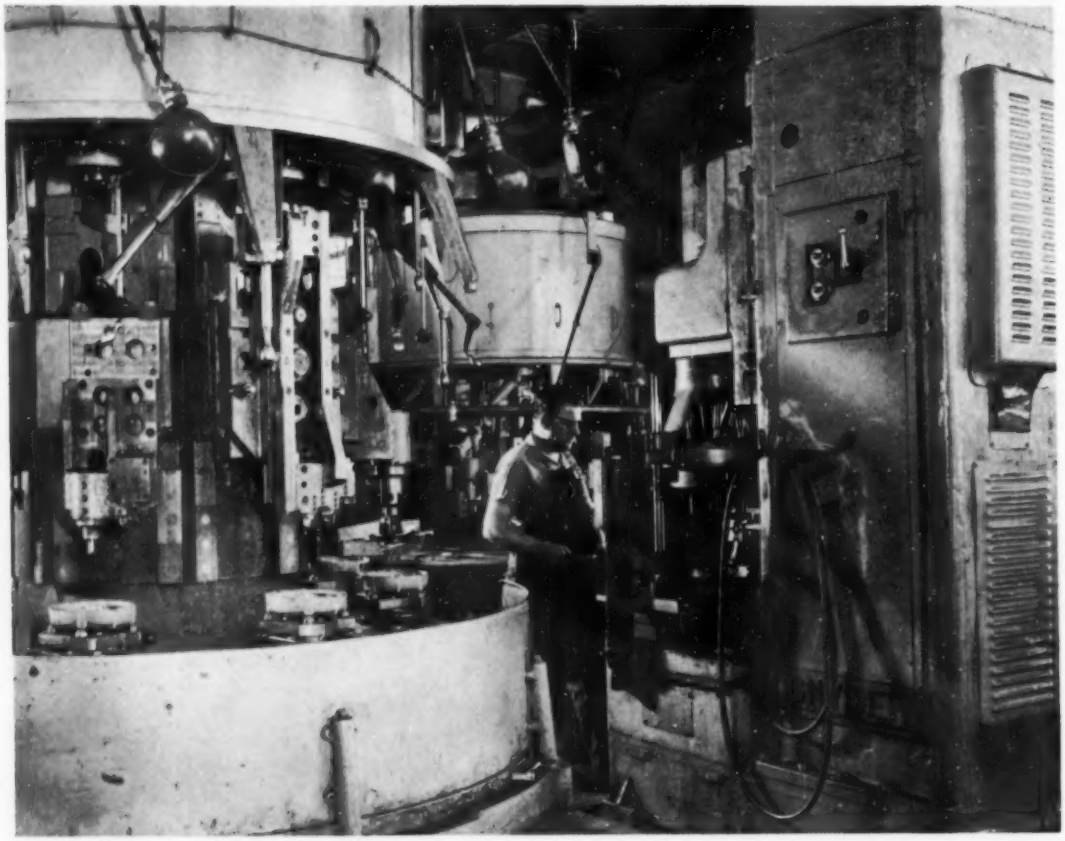


Special multiple-spindle turbine blade millers are used at Allis-Chalmers Mfg. Co. Tracer techniques make operation of these machines fully automatic except for one man at control panel.

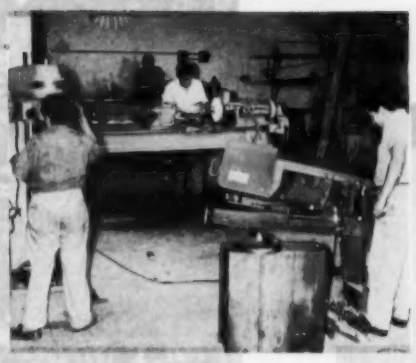


Single-purpose, multiple-head drill machines eight holes at Wisconsin Motors Corp. Machine was built from standard components.

Primer coat for Rambler automobile bodies suspended from overhead monorail conveyor is applied in dip tank at American Motors Corp., to insure that interior as well as exterior surfaces receive a uniform protective coating.



At the Louis Allis Co., one operator turns and bores electric motor heads on a Bullard Multi-Matic machine, then drill holes in the part on a Snyder machine. Use in this Milwaukee plant of modern machine tools and efficient layout of the two machines results in higher productivity and lower costs.



Hospital furniture plant, typical of the small Mexican shop, shows workers endeavoring to produce production quantities by handicraft techniques. But nation is making rapid progress, symbolized by background drawing of library on University of Mexico's stunning new campus.

'Señor' Members Forming Chapter

THE TWO HOUR SIESTA is giving way to the ten-minute coffee break in Mexico.

Industrialization is coming. And it's coming so fast that it's knocking sombreros off and waking up the traditionally lethargic republic.

As expressive as anything of the recent rapid strides toward industrialization is the movement to organize a new ASTE chapter of "Señor Members."

Nucleus of the new chapter has already been formed in the great capital city. Consisting of a score of members-at-large and a growing number of interested tool engineers, the embryo organization hopes, quite realistically, to qualify for a charter before many weeks pass.

Several temporary officers have been chosen. Heading the organizational drive is a past chairman of Houston chapter, John Bailleres, who is now living in Mexico City and working as a tool engineer for Perforadora Latina, manufacturer of oil field tools and tractor parts. Besides Chairman Bailleres, other pro tem officers include Frederick Delgado, membership chairman, and Julio N. Garcia, secretary. Both Delgado and Garcia are field engineers for Amertool Services, Inc., Cincinnati. Also backing the formation of the Mexican chapter is former Detroit Chapter Chairman Mostaff.

Membership potential is great and growing greater in Mexico City, world's seventh largest city with a population that tops Chicago's. Although many of the members would come from plants that are south-of-the-border extensions of American firms, even more would represent indigenous small shops that are rising in the industrial centers of the nation.

The Mexican tool engineer is in about the same situation that his American counterpart was in during the depression of the Thirties. He is being asked to increase productivity and quality and spend little, if any, money on capital improvements.

Generally the American visitor's first impression of plants in Mexico is that most of the production facilities should be scrapped. Besides antiquated equipment, methods are often relatively primordial. Many shops attempt production quantities with handicraft techniques. Drawings, standards, or written instructions are sometimes entirely lacking; work is done by memory. Each operator may produce a piece of equipment almost entirely by himself, often being a sheet-metal worker, machinist, welder, and metal finisher all during the same day.

There are real barriers to improvement of these

conditions. When one considers the prevailing labor rates (18 cents an hour or so) and interest costs (often 20 percent), one can readily see why Mexican management hesitates to invest in new equipment. Labor is too cheap, the pay-off period of the new equipment is too long for risk, and working capital is usually difficult to obtain anyway.

Five-Year Plan Sparks Progress

Many tool engineers are finding that much can be done to improve productivity even under these adverse conditions. Furnishing specific impetus has been a Mexican Industrial Productivity Center, instituted in 1955 at the behest of industry and government. It grew out of an agreement signed March 5, that year, between the governments of the United States and Mexico, providing for a cooperative effort to increase productivity during a five-year period terminating June 30, 1960.

Under this five-year plan, the United States agreed to provide short-term technical consultants for training and industry-study programs; a productivity team and individual technical studies in the United States; a permanent staff to aid Mexicans in the planning and implementation of the program; and technical aids such as films and documentation.

Industrial engineering teams sponsored by the program are performing a dual function for Mexican industry: in the role of consultants they are working to improve productivity, with the cost of this service being borne by industry; and they are offering night-school courses in such industrial engineering disciplines as manufacturing methods, cost control, production control, quality control, and industrial organization.

Although tool engineering is still only a few years old in Mexico—with much work still remaining to be done in the basic fields of methods, standardization, division of labor, work measurement, production and cost control, etc.—there are already appearing some evidences of maturity. Engineers are already turning to the newer and more complex manifestations of tool engineering such as operations research techniques, automatic data processing, automation.

And as a result of this growing interest and need for more efficient production methods, Ibero-Americana University is offering for the first time in Mexico a postgraduate course in industrial engineering.

The future of Mexico and the future of the tool engineering profession augurs well indeed for the budding ASTE chapter's opportunity to grow, and to serve.

Members Approve Amendments

VOTING MEMBERS of the ASTE have approved two constitutional amendments by referendum ballot.

The "yes" vote was overwhelming in both cases. As provided in the Constitution, approval is signified by a majority of votes cast, rather than a majority of the total membership.

One of the amendments changes Article X, Sec. 2 of the Constitution to make the retiring president of the Society automatically a director for a term of one year following his term as elected director, instead of, as previously set forth, "a director from the date of his retirement until the next Annual Meeting."

The old phrasing prevented the retiring president from fully serving his last term as an elected director, and left the board with only 14 members for the period between the Annual and the Semiannual Meetings. Under the new amendment, the board will have its full 15 members throughtout the year.

The other amendment changes Article IV. Sec. 8, to read: "A student member must be enrolled in a technical institute, college or university, studying tool engineering or related engineering, or in a related established apprentice training system offering course work equivalent to courses in mechanical technology given at the technical institute level." The change deletes the word "recognized school" from the former phrasing.

Both amendments, as proposed in petitions, were originally approved by a majority of the C&B committees in chapters before being put to the membership for vote. All the Society's

Members in the News

WALTER K. BAILEY, president of the Warner & Swasey Co. and member of Cleveland chapter, has been elected to the National Industrial Conference Board. Founded in 1916, the board is an independent and nonprofit institution for business and industrial fact-finding through scientific research.

Directors of Automotive Conversion Corp., Birmingham, Mich., have named GEORGE R. SQUIBB, member of Macomb County chapter, as president of the corporation. Squibb has been chief project engineer of the process development section, General Motors Tech Center. A registered engineer in both Michigan and Ohio, he spent 15 years with The Cincinnati Milling Machine Co. and also was subsequently chief engineer with the Detroit Broach Co. His new appointment is with a firm that modifies station wagons into dual-purpose vehicles so that the unit can be converted from a work vehicle to family use, or vice versa, very rapidly.

HAROLD E. ("RIP") COLLINS, immediate past president of ASTE and manager of the overseas manufacturing department of Hughes Tool Co., Houston, Tex., has been designated a member of the National Defense Executive Reserve for his help in industrial mobilization planning. Collins was commended by U.S. Commerce Secretary Lewis L. Strauss.

A division vice president of The Sheffield Corp., JACK T. WELCH, has been re-elected president of the Ultrasonic Manufacturers Association for a second term. Welch belong to Dayton chapter. His company pioneered in the development and application of ultrasonic energy—called "silent sound" because it is above the range of the human ear. In addition to machining metals and ceramics, ultrasonic energy is used for testing and welding.

ESMONDE J. BUSHEY, Northern Massachusetts chapter, has been named works manager of the Athol Div., The Union Twist Drill Co., succeeding George W. Grover, Sr., retired. . . . GEORGE W. FRICK, president of Frick Steel Co. and member of Pittsburgh chapter, has signed EDGAR ("SPECIAL DELIVERY") JONES as a sales representative. Jones, also an ASTE member, will be remembered by many for his years with the University of Pittsburgh Panthers and the Cleveland Browns football teams. He joins the Bridgeville, Pa., firm from the Latrobe Steel Co. . . . JAMES H. DODGE, Detroit chapter,

Jones

Dodge

Peterson

has been named sales manager of specialty steels at the Latrobe, Pa., home office of Latrobe Steel. He has been regional sales manager at Detroit for 14 years and has been a member of the firm's sales staff for a quarter of a century. Succeeding Dodge in Detroit is ROBERT V. PETERSON.

GEORGE S. CHIARMONTE, Hartford chapter, has been appointed sales manager of the Cogsdill Twist Drill and Threadwell Tap & Die divisions of The Sheffield Corp. Well known in New England industrial distributor circles, Chiarmonte joins the Greenfield, Mass., concerns after serving 11 years as sales manager of the Horton Div. of United-Greenfield Corp. . . . F. J. JESCHKE and G. M. CALVERT, Detroit chapter members, have sold their firm, the Jes-Cal Co. of Fraser, Mich., to the National Automatic Tool Co. of Richmond, Ind. Jeschke and Calvert, pioneer developers of honing tools, will remain with the company as vice presidents. Natco, builder of multiple spindle machine tools, plans to develop and build a machine to utilize the size control honing tools manufactured by Jes-Cal. . . . WILFRED R. OGG, Chicago chapter member and district manager of the Norton Co.'s Grinding Machine Div. since 1951, has been promoted to manager of distributor sales for the division. He will supervise midwest machinery distributors who report directly to the Worcester, Mass., main office, and will also have charge of export sales through Norton Behr-Manning Overseas, Inc. . . . EARL TAYLOR, Muskegon member and tool and methods engineer for Wales-Strippit, Inc., manufacturer of hole punching and notching equipment, has been transferred from Western Michigan to a territory centered in south Chicago.

Dayton TV Program Serves as a Model For Other Chapters

DAYTON—A tool engineer's first obligation is to make something better. His very next obligation is to make it obsolete.

This dynamic philosophy of progress and obsolescence, especially as it affects the Dayton area, was depicted for area television watchers recently by Sinclair College. The panel for the program, "The Romance of Tool Engineering," included ASTE National President George A. Goodwin.

One of a "Culture Beat" series being presented by educational TV station WLW-D, the half-hour show so well explained for the layman the theories, practices and contributions of tool engineering, that copies of the script are being sent to all chapter public relations chairmen. The national public relations committee, through Public Relations Director Richard Gebers at Headquarters, has expressed the hope that the script will provide a model to aid other chapters in planning similar TV programs in their areas.

Host and moderator was Walter E. Loomis, industrial coordinator for Sinclair College (which, incidentally, has one of the newer student chapters flourishing on its campus). Others who contributed to the success of the program were H. C. Poock, head of factory layout for the National Cash Register Co.; Robert S. Esken, supervisor, sales and engineering, The Sheffield Corp.; and William C. Carper, engineering and sales representative of the Viking Tool and Die Co. All panel members are on the 12-man Tool Engineering Technology Advisory Committee of Sinclair.

The panel also brought out that the end results of tool engineering provide employment for 3500 in Dayton job shops, which have annual earnings in excess of $15 million and represent an investment of over $50 million. In tracing the historical development of Dayton into one of the leading tool centers of the country, Carper gave much of the credit to the city's famous citizens, the late "Boss" Kettering and John H. Patterson of the N.C.R. Co.

Esken said the tool engineer must know materials, processes, skills, and equipment. And then, by combining these ingredients—men, materials, measurement, and machines—he builds the products of everyday living.

Goodwin, who is works manager of the Master Electric Div., Reliance Electric and Engineering Co., defined tool engineering and explained the vital part ASTE plays in promulgating the profession.

Panel members on Dayton TV show were (left to right) Robert Esken, The Sheffield Corp.; William Carper, Viking Tool and Die Co.; Walter Loomis of Sinclair College; ASTE President George A. Goodwin; and Herman Poock, National Cash Register Co.

chapter news and views

LITTLE RHODY—On hand to answer questions resulting from a talk given by Raymond Zale, first vice chairman of Pittsburgh chapter and general sales manager, Vulcan-Kidd steel division, on "What Constitutes a Tool Steel," were (left to right) Melvin H. Knapp, chief metallurgist, Brown & Sharpe Mfg. Co.; Zale; Norman Robinson, high-speed metallurgist, also of B & S.; Prof. Kenneth Mairs, University of Rhode Island; and Wilson C. Pine, C. I. Hayes, Inc. *—Alfred P. Dion, Jr.*

CENTRAL CONNECTICUT—Receiving their affiliate membership plaques from Acting Chairman John Cameron are (left to right) Leslie Julian, president of the Bristol Machine Tool Co.; Joseph Petrosky, president, Federal Machine Tool Co.; and John C. Cluney, general manager, Superior Steel Products Co. Looking on is Edward F. Wall, affiliate membership chairman. These affiliates, and others to be added in the near future, have strengthened the scholarship program of the young (year-old) chapter. *—Kenneth Sullivan*

Southern Tech Hears Panel on Dimensioning

ATLANTA—Members of the engineering staff of Lockheed Aircraft Corp., Georgia Div., Marietta, presented a panel discussion on "Dimensioning for Realistic Tolerancing" to ASTE junior members at Southern Technical Institute Jan. 13. The seminar for Student Chapter #16 had been presented previously to the parent Atlanta chapter. Jim Craig, Lockheed project coordinator and chapter program chairman, played a prominent part in the repeat performance for the students.

Included among the speakers and their topics were: H. E. Bryan, aircraft design engineer, talking on the design engineer's concern for the size and shape of a part and for what the part must accomplish; H. H. Cherry, production design engineer, discussing his role in the planning of a part in relation to other parts that would be assembled to it; W. R. Dawkins, manufacturing planner, telling of the considerations necessary for the making of the part, especially in its unfinished form; and C. C. Lowry, project tool engineer, explaining how available equipment had a bearing on the dimensioning of the part while it was still in the design stage.

Still another guest, J. W. Ealey, senior tool engineer, brought to the students' attention the role that special jig fixtures and tools play in the manufacture of the part and the way proper tolerances help.

W. H. Hutchinson, production liaison group engineer, served as moderator for the panel discussion after being introduced by Craig. *—L. C. Volberding*

Lockheed engineers who assembled in Atlanta for the panel discussion on dimensioning for tolerancing were (left to right) J. W. Ealey, C. C. Lowry, W. R. Dawkins, H. H. Cherry, H. E. Bryan, and W. H. Hutchinson. *—Lawrence G. Cuba*

Obituaries

Adrian A. Andrus, Memphis, sales engineer for DoAll Co.

Henry Bruewer, Cincinnati, production engineer for Schaible Co.

Amandus C. Brunssen, New Haven, manager of Bamber Tool Supply, Inc.

William Otto Giessman, charter member of Santa Clara Valley chapter; owner of Able Tool Designs Shop.

James Glasgow, Montreal, tool engineer for Williams and Wilson, Ltd.

Charles J. Gluck, past chapter chairman, Fairfield County. Sales and service representative of O K Tool Co.

Karl W. Hooth, Kalamazoo, chief draftsman for Checker Cab Mfg. Co.

Gideon Kane, Fond du Lac, president of Packer Mfg. Co.

Raymond P. Lutz, Albuquerque, director of research division for Western Electric Co.

Ernest J. Mayer, Tri-Cities, tool engineer for John Deere Plow Works.

John A. Mitchell, Springfield, Mass., vice president of Mitchell Machine and Tool Co.

Charles A. Senner, Baltimore, retired tool designer for Bendix Radio Corp.

Edward J. Sharkey, Ashtabula, assistant superintendent of Astatic Corp.

Perry Manning Simonds, Houston, chief plant engineer for General Metals Corp.

Eric H. Youngberg, Sacramento, engineer planner for Aerojet General Corp.

ROCHESTER—Chapter members inspect the display of modern tool-cutting devices that accompanied C. G. Schelly's talk on "The Story of the Cutting Edge." *—Walter F. Hauser*

chapter news

Test Pilot, Then and Now, Depicted for Long Island Fathers and Sons

LONG ISLAND—Contrasting the leather-jacketed, white-silk-scarved test pilot of the past with today's space-suited, oxygen-masked flier, test pilot Ralph Donnell of Grumman Aircraft Engineering Corp. explained the difference between the initial orientation of the two types of daredevils. Whereas the earlier breed was simply one with enough guts to take up a new plane, put it through its paces and bring back all the data he could scratch on a kneepad, the pilot of today is in consultation with the design engineers from the time of the plane's conception, Donnell said. He is completely familiar with the cockpit and all its gadgets before he even climbs into the finished aircraft. Tests proceed sometimes for months. Structural changes based on data the pilot gathers, continue until the craft is completely checked out.

The scene of all this high-flying talk was the Long Island chapter's Father and Son meeting at the Grumman plant. To illustrate his point further, Donnell outfitted one of the youngsters present in test pilot's gear, complete from the Anti-G suit which prevents blackouts, to the rubber life raft which is clipped to the pilot's chest.

George Titterton, vice president in charge of contracts at Grumman, discussed the company's development from a garage employing six people to an organization with multiplant facilities for 12,000.

Dinner for the 300 present was followed by a tour and inspection of planes now in production.

—W. Lamberta

Machining Rate Problem Discussed at Cincinnati

CINCINNATI—Speaking on "Machining of High Temperature Alloys for Missile Hardware" at Cincinnati's December gathering was Robert Halverstadt of General Electric. Halverstadt discussed an alarming fact: on many of the high-temperature alloys being used today it has been found the machining rate has decreased, and is equivalent to the rate of machining in 1900. This presents a new problem, he said. A new cutting tool must be developed to increase the machining rate of these alloys to meet the present day demands. Halverstadt further clarified his point by use of color slides.

—Clarence Keller

Bruce Bjork, son of a chapter member, is being used as a model for the typical test pilot gear by Grumman test pilot Ralph Donnell.

Big Turnout Maintains Chapter's High Average

NORTHWESTERN PENNSYLVANIA—With more than 50 percent of the chapter membership in attendance, guest speaker D. P. Pratt of the Dow Chemical Co. suffered no lack of attention when he spoke on "Magnesium Tooling Plate" at the January meeting. Pratt stressed the light weight, low cost, and machinability of magnesium tooling plate, together with its production and its uses.

The average attendance at all meetings for the past two years has been at least 50 percent of the 108 members.

Facts and Fallacies About Carbide Dies Given at Evansville

EVANSVILLE—Some 70 members and guests of Chapter #73, meeting on Jan. 16, heard an hour-and-a-half discourse on the advantages and the shortcomings of carbide dies from one of the leaders in the field.

Don Oberg, president and general manager of the Oberg Mfg. Co. in Tarentum, Pa., stressed that carbide dies are not a cure-all for quantity production problems. He punctured the illusion, "spread by an unethical and as yet unidentified" manufacturer, that carbide dies in themselves will improve feed. "The speed of your press is determined only by the accuracy of feed, whether your dies are carbide or not," he said.

He offered one tip to Evansville tool engineers: try lubricating the bottom, as well as the top, of stock for a sharp 20 percent or so increase in production and tool life.

"Above all," Oberg said, "no matter what your problem or what your solution, buy the best equipment available. If you can't afford it, wait until you can. For the best equipment is not good enough in the ever-improving tool engineering field."

Slides illustrated various dies turned out by the 66-man Oberg shop, and questions from the floor during the talk helped maintain informality and interest during the session.

Members balloted on National Board of Directors nominees.

—M. L. Stone

SANTA MONICA BAY—Two color films and a talk on modern steels were presented by William Baldwin (right), technical manager, Western division of the Allegheny Ludlum Steel Corp.; and Alfred E. Beaumont (left), sales manager of the same company. With them is chapter Chairman Ken Boucher.—*Charles V. Livezey*

Aid 'Give-aways' Draw Fire of Industrialist At Executive Night

SPRINGFIELD, OHIO—"College educations for wealthy Iranians, free air trips to Mecca for thousands of Arabs, dress suits for Grecian undertakers, and public baths for Egyptian camel drivers"—such alleged misuses of American tax dollars drew the fire of a Cincinnati industrialist speaking to 135 members and guests at Springfield chapter's annual Executive Night.

Taking a humorous approach to a serious subject, the industrialist, President William L. McGrath of the Williamson Co., cited some of the frivolities on which our tax revenue is spent. Existing, he said, are situations such as shiploads of farm tractors and power machinery rusting on Greek docks; a $128,000 cow barn showing Lebanese living on $100 a year the only way to get ahead in agriculture; a million-and-a-half dollars' worth of prefab steel to erect grain silos and warehouses untouched in Calcutta while more money is on the way for 600 more warehouses; a depot in Laos crammed with enough drugs, hypodermic needles, and other medical supplies to care for much of Southeast Asia; and finally, $14,500,000 for airports in Afghanistan where the camel is the most popular means of transportation and few people can read or write.

"This type of foreign aid should be cut off immediately and the funds, if necessary, be diverted to projects for protecting our country," said McGrath, a former U.S. Employer Delegate and member of the governing body of the International Labor Organization at Geneva, Switzerland. "Right there we could get all the money we need for the satellite and missile program without increasing taxes."

The speaker at the Springfield Country Club affair wound up his criticism of what he called America's foreign "give-away programs" by disclosing the fact that the United States has given postwar grants to Soviet Russia and its satellites which have cost taxpayers in excess of one-and-a-half billion dollars. —*Kenneth W. Keller*

C. V. Briner

Word was received at press time that C. V. Briner ASTE president 1945-46, passed away in Cleveland, Ohio, on Feb. 10, 1959. Further details will appear in the April issue of the magazine.

Boeing Aircraft tooling leaders who participated in the "Space Age" panel discussion were (left to right) W. G. Norman, chief tool engineer, pilotless aircraft division; C. S. Robinson, chief tool engineer, transport division; B. K. Bucey, assistant to vice president of manufacturing; L. B. Barlow, manufacturing engineer manager, Seattle division; K. E. Gates, chief tool designer, industrial products division.

Space Age Problems Discussed in Seattle

SEATTLE—"Tooling for the Space Age," a panel discussion concerned with the problems that have arisen with the advent of hypersonic aircraft, was presented at the January meeting. New materials which must withstand the tremendous heat generated by high speeds will increase the burden of fabrication and require closer tolerances. These problems may be solved by the use of numerical control. But, as the panel stressed, even this process presents certain pitfalls that today's tool engineer must remain aware of.

The panelists, representatives from the Boeing Aircraft Co., all agreed that the tool engineer is about to step into a new age—one that is both mysterious and challenging. —*Randolph Haugen*

Elmira Members View Efforts To Cut Costs

ELMIRA — The Shepard-Niles Crane and Hoist Corp., whose products do not lend themselves to high production of a standard line, directs most of its efforts toward "made-to-order" hoists. As a result, the firm, scene of the Elmira chapter's plant tour, has conducted several experiments in an effort to cut costs and keep specifications high. One such experiment was viewed by the members. In the pattern shop they found that, because cornstalk pressed board had a tendency to shrink a great deal, it could not be used for templates. Although this board is more expensive than plywood, it would have been better in the long run for close tolerance templates had it passed the shrinkage tests.

Also under inspection were the company's own housing for an electric motor—more and more companies are making their own electric motors, some ASTE members observed—and a king-size jig developed to handle the large "bridge" sections for welding.

—*Peter Doll*

Formula for Success Given to Engineers

DETROIT—In order to get a better job, you have to outgrow the one you're in, members and guests of the chapter's carbide section were told at the meeting in the Rackham Memorial Building Jan. 15.

The speaker was L. B. ("Tex") Ragsdale, staff engineer of the Ternstedt Div. of General Motors. He listed the laws that govern individual success as desire, knowledge, work—and, most important of all, the ancient tenet of treating your fellows as you would have them treat you.

"There's just a short distance between a pat on the back and a kick in the pants," said Ragsdale, "but there's a world of difference in the reaction they get."

"Tex," who has been working with engineering personnel since 1942, came to the defense of their humanity in his talk entitled "Are Engineers Human?"

"If to err is human, engineers are the most human people in the world," he said. In less whimsical moments of his inspirational talk, he defined human engineering as "taking the basic moral laws and enforcing them so completely that you can build for yourself and others a better life."

Examining a largt motorized rotary jig while on Elmira chapters plant tour of the Shepard Niles Co., Montour Falls, N. Y., is H. L. Weldon, member from the National Cash Register plant in Ithaca.

COLUMBUS—Speaking on "American-Made Machine Tools Versus European-Made Machine Tools" at a meeting of Chapter 36 was Harold E. ("Rip") Collins, ASTE national director. Pictured at the dinner which preceded the talk are (left to right) Jim McKinney, secretary; Carl Hooge, past chairman; Prof. Jay Edmondson, Ohio State University; Collins; Chapter Chairman Archer B. Jones; Robert E. Snider, first vice chairman; and Carl Winkelman, second vice chairman. *—G. E. Rauberts*

chips and chatter

Twin States

One hundred five members and guests attended the Jan. 14 joint meeting for Twin States and Monadnock ASTE chapters and the New Hampshire chapter of the American Society of Quality Control. "Finding the Facts before Setting the Specifications" was the topic discussed by Julien Toulouse, quality control consultant. Dr. Toulouse is one of the leading world authorities on quality control and statistical methods.

Lima

"Industry and ASTE—Working Partners" was the subject of a talk given by H. Dale Long, national vice president, at the Jan. 15 meeting, where 61 members, executives and one educator met for their executive and educators meeting. Long told about the things that ASTE does locally and nationally to help industry and ASTE members keep up with the knowledge and application of the latest things known in manufacturing.

Lansing

D. A. Chubb, chief engineer, Abrams Instrument Corp., spoke to 48 members at the Jan. 12 meeting. Chubb spoke on radio interference testing.

Keystone

"Properties of Basic Mechanisms and Cams Used in Automatic Machinery" was the subject of a talk at the Jan. 19 meeting by C. N. Neklutin, vice president-engineering, Ferguson Machine Corp., division of Universal Match Corp., St. Louis. Neklutin dealt with the theory of cam dynamics and research into the field of cam limitations, by selecting a cam acceleration characteristic most suitable for the motion desired and then determining the velocity diagram and displacement chart mathematically by integration.

Santa Clara Valley

At the Jan. 20 meeting John R. Ginson, product manager of Reliance Magnesium, spoke on "New Era in Tooling through Magnesium." He enlarged upon the use of magnesium tooling plate for production as applied to jigs, fixtures and inspection tools, where ease of machining, weldability and light weight are cost-cutting factors. His talk was illustrated by slides and a movie, showing standard shop methods for handling magnesium during machining and welding operations. Election of officers followed the technical part of the meeting.

Northern Massachusetts

"Machinery Electrification for Labor Savings" was the subject of talks given by D. R. Percival, president, and F. P. Dunigan, vice president and manager, Machinery Electrification, Inc., at the Jan. 20 meeting. Eighty members and guests were told how production costs can be reduced by modernization of old equipment. The importance of loading control through machinery electrification was emphasized with color slides and a display of apparatus demonstrating special load control features.

Denver

Another class in tool design is under way at the Colorado University Extension Center in Denver. The class started Feb. 6 and will continue through June 5. Emphasis is placed on the importance of tool design in relation to the economical manufacture of products. Welding, cutting tools, punch and die design, gages, jigs and fixtures, automatic screw machine cam design and turret lathe tooling are being covered. One hour and forty minutes of the class period is spent in lectures, the remainder of the four-hour period being reserved for lab work.

Mid-Hudson

"Manufacture of Progressive Dies" was the subject of a talk given by Chester H. Hamilton, sales engineer for the B. Jahn Mfg. Co. Many of the techniques involved in the manufacture of progressive dies were illustrated by use of films, accenting the importance of the tool and die maker's skill.

California Polytech

Since the innovation of epoxy resins with their dimensional stability and resistance to impact, plastic tooling has become practical. So said W. B. Cornner, manager of Western Sales Div., Rezolin, Inc., in his talk before 70 student members and guests at the Jan. 14 meeting. He also noted the advantages of the ability of plastics to adapt to compound surfaces and of the light weight of plastic tools. Two special guests at this meeting were Paul Link and Ed Cutler, of the sponsoring Los Angeles chapter. Cutler, a member of the national education committee, gave a short talk on this committee's aims and functions.

PHILADELPHIA—Malcolm F. Judkins (left), director of new products development at Firth Sterling, Inc., discusses his subject for the evening, machinability, with Len Horoff, second vice chairman of Chapter 15. *—Jerry Weiland*

SPECIAL EVENTS

ASTE 27th Annual Meeting	April 18-22	Schroeder Hotel, Milwaukee, Wis.
Seminar—Analysis of Metal-Cutting Methods	March 11-12	Bond Hotel, Hartford, Conn.
Seminar—Tooling for Metal Powder Parts	March 24	LaSalle Hotel, Chicago, Ill.

CHAPTER MEETINGS

PLACE	March	SPEAKER	SUBJECT
Central Pennsylvania. Red Lion Country Club. 6:30 pm	5	**ASTE President George A. Goodwin**	Executive night; installation of officers
Cleveland. Cleveland Engineering and Scientific Center. 6:30 pm	12	**Judge Samuel Gilbert**	Juvenile Court Cases—Facts and Figures
Elmira. Mark Twain Hotel. 7 pm, dinner	7		Ladies night
Hamilton District. Brant Hotel, Brantford. 6:30 pm	13	Representative of Giddings & Lewis	Machine Controls
Hendrick Hudson. Pannetta's Restaurant. 7 pm	18		Installation of officers
Indianapolis. Antlers Hotel. 6:30 pm	5	**C. A. Barrett,** Die-Draulic Grip, Inc.	Die Design with Simplified Hydraulic Pressure. Past chairmen's night; installation
Lansing. Home Dairy. Dinner, 6:30; meeting, 8 pm	9	**C. D. Harrington,** Oldsmobile Div. of GMC	Styling of the New Car. Installation of officers
Little Rhody. Johnson's Hummocks Restaurant. 6 pm	5	**Francis R. Springer,** Denison Engineering Div. of American Brake Shoe Co.	Oil Hydraulics on the Production Line
Louisville. University of Louisville. 7:30 pm	17	**Stanley Cope,** Acme School of Design	Die Design
Merrimack Valley.	5		Executive night. Installation of officers
Milwaukee. Serbian Hall.		**R. J. Zale,** Vulcan Steel Co.	Understanding of Tool Steels Election of officers
Mississippi. King Edward's Hotel. 8 pm	14		Installation of officers
Montreal. Canadian Legion. 7:45 pm	18		Installation of officers. Educational and technical films
New Haven. Waverly Inn, Cheshire. 6 pm; dinner at 7:30	4	**Steve Halloway,** Waterbury Farrel Foundry and Machine Div. of Textron	Site Selection and Plant Location. Plant visitation
North Texas. Western Hills Inn. Hwy. #183, Euless. Social hour, 6; meeting, 7 pm	13	**E. B. Wellerd,** Carboloy	Fundamental Applications of Carbide Tools. Movie "Generation 5"
Northern Massachusetts. Greenfield. 7 pm	17	**Wilfred Pender,** ASTE National Director	Ladies night; Installation of officers
Northwestern Pennsylvania. Moose Home. 6:30 pm	5	**Dale Long,** ASTE Vice President	Tools and Tooling Problems. Installation of officers
Oregon State College. College Memorial Union Bldg., Room 208. 7:30 pm	11	**Ben Berlien,** ASTE National Director	First anniversary
Portland (Ore.). Piluso's Theatre Restaurant. 6:30 pm	26	**William H. Rice,** Esco	Welding Castings for Component Parts for Nuclear Power. Installation of officers
Saginaw Valley. High-Life Inn. 7 pm	19	**Kenneth Treer,** Grey Equipment Co. of Ohio	Small Assembly Automation. Installation of officers
Santa Ana Valley. Palms Restaurant. 7 pm	3		
Schuylkill Valley. Goodwill Fire Co. ballroom. 5:30, program; 7, dinner.	10	**David Schrom,** ASTE Vice President	Affairs of National Headquarters. Installation of officers
Worcester. The Hickory House. 7 pm	24	**Charles J. Koebel,** Koebel Diamond Tool	Evolution of Diamond Use in Industry

Catskill Region

E. V. Crane, chief development and research engineer at E. W. Bliss Co., was guest speaker at the December meeting. Crane reviewed the improvements in the punch press field, such as better controls and design.

Syracuse

Seventy-five members and guests heard National Vice President H. Dale Long speak on "Industry and ASTE—Partners in Progress" at their first "Bosses Night" meeting Jan. 13. James Mosser, the technical speaker talked on patents.

Positions Wanted

PROCESS ENGINEER—Time study engineer, 44 years old. Experienced in sheet metal stamping, metal stampings and fabrication, wire fabrication, steel and aluminum machining, assembly operations and finishing operations. Includes estimating, methods, time study, processing, tooling, costs, cost reductions, layout, etc. Will furnish resume to interested parties. Willing to relocate. Write to: Box 138, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

TOOL ENGINEER—A graduate mechanical engineer, 28 years old with good experience in tool fabrication (press tools, dies, gages, jigs, fixtures and plastic tools, etc.) in a manufacturing industry, desires position as a tool engineer. Also a member of ASTE. Write to: Box 139, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

Positions Available

SALES REPRESENTATIVES WANTED—Well-established and growing company making custom tools from epoxy resins, fiber-glass and related materials needs representation in the following states: Western New York, Maine, New Hampshire, Vermont, Connecticut, Massachusetts, Rhode Island, North Carolina, and Ohio. Liberal commission and exclusive territory given to right men. Write: Latrobe Plastic Co., 310 Unity St., Latrobe, Pa.

POSITION OPEN—Sr. machine designer, minimum seven years' experience designing small intricate mechanism of extreme precision. Real growth opportunity in a young, progressive, and substantial company manufacturing magnetic recording tape for expanding applications. Warm climate and associations. Salary right for a real pro. Write ORRadio Industries, Opelika, Ala.

CHIEF MANUFACTURING ENGINEER—The man we seek has a record of accomplishment in his field and has about 10 years' experience in process determination of both stamped and machined parts, or related engineering, proven performance as an engineering department head or assistant in a sizeable company. Familiarity with tool design and machine design and knowledge of conventional mass production methods combined with a fresh approach to new ideas. Degree in mechanical or industrial engineering required. This position carries full department head responsibility and is available only due to expansion of this function. Please send complete details including salary requirements to K. B. Cook, Personnel Dept., The Stanley Works, New Britain, Conn.

SALES REPRESENTATIVES—To handle piercing punches, die and stripper bushings. Choice territories available. Hudson Mfg. Corp., 12 E. Willow St., Millburn, N. J.

Progress in Production

SUPERFINISHING SPEEDS PRODUCT IMPROVEMENT PLAN

Maintaining its operation costs fairly steady while increasing product quality has been accomplished by DoAll Co. through adoption of a general purpose superfinisher made by Gisholt Machine Co. Utilizing this equipment on many parts used in the DoAll machine tools appears to have given them improved performance with less maintenance. The superfinishing operation cost is balanced by the fact that superior finish on

Simple setup on Masterline Model 52A general purpose Superfinisher installed as part of DoAll's continuous product improvement program. Operator checks the final OD dimension on a rod just finished on the machine.

parts eliminates need for polishing at the plating shop prior to chrome plating.

Nearly all of the band machines, surface grinders and other machine tools manufactured by DoAll use one or more hydraulic cylinders. Although the piston rods for the cylinders were ground to a 16-rms surface finish and chrome plated, some leakage took place past the rod seals. Highlighting with the Gisholt machine disclosed grinding difficulties such as lobes and chatter. The 30 to 50-rms requirement for superfinishing simplified correction of the grinding problems. Rods are now superfinished to a 7 to 8-rms surface finish which is free of lobes or chatter.

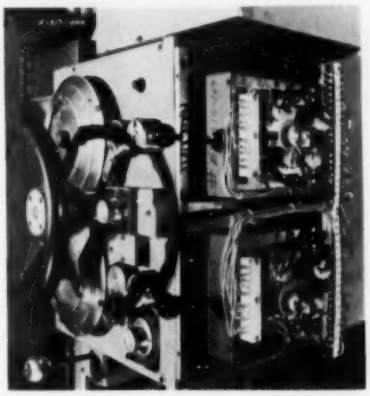
Checks at the service department of DoAll show that field reports of hydraulic oil leakage have stopped with the advent of the rods finished in the new manner. Apparently the improved surface also has resulted in longer seal life. As a consequence, all piston rods now are superfinished, although in some cases this operation is restricted to the rod-seal area.

TURRET LATHES JOIN TAPE CONTROL OPERATIONS

New techniques are putting numerically controlled vertical turret lathes into a class of everyday industrial tools. A discrete positioning system developed by Kaukauna Div. of Giddings & Lewis Machine Tool Co. provides a versatility that alters the economics of machining a variety of work on vertical turret lathes and may bring to broader usage the recent progress in carbide tooling. Quick setup, fast operation of the machine between cuts, high cutting speeds and consistent high quality of finished parts combine for reduced costs. A primary advantage of the development is that it suggests the economy of automatic control for short-run jobs.

The tape system exercises complete control over feeds, speeds, turret indexing, automatic dwell and coolant supply, as well as over all auxiliary functions which the machine is capable of performing. In programming, movement of the heads and table can be coordinated so as to minimize cycle time and avoid mechanical interference. Head and ram motions can be programmed for simultaneous feed to permit moving tools at 45 deg. Rotation of power turrets can be controlled in either direction.

Through an override adjustment control, the operator can add information to the data system in the form of fine adjustments to either height or radius. Once such adjustments have been made, they automatically become part of the program, whether they are made during setup or actual operation to compensate



Flexibility of the adjustable coordinate system is furthered by the feedback resolvers which are connected to the lead screws in the feedbox by spring-loaded serrated face clutches. The machine positions automatically to program location; then the operator disengages the resolver unit to reposition the machine.

for tool wear or deflection. For this, a bank of 50 potentiometers in the operator's console allows individual cutter adjustments within ±0.010 in. The operator records all compensating corrections as they are made. After the first piece has been completed, the tape automatically selects the proper adjustment control, and no further operator attention is required. A loop storage box permits the tape program to be spliced into an endless belt that can be repeated over and over without reloading.

AUTOMOBILE MAKERS UTILIZE POWDER METAL ADVANTAGES

Powder metallurgy is decidedly entrenched in the "big time" with statistics to verify its uses in current automobile building. As an example of the depth to which powder metallurgy has penetrated car design, Ford's Fairlane 500 Fordor uses five lb of powder metallurgy hardware and accessories in addition to structural and other parts, while American Motors and Studebaker-Packard

cars show a similar trend in new models. Chrysler reports an average powder metallurgy structural parts usage of over six lb and General Motors says well over seven lb are used in their cars. These estimates are aside from powder metallurgy used in components or subassemblies purchased from outside sources.

Kempton H. Roll, executive secretary of the Metal Powder Industries Federation, makes this appraisal: "Nobody can produce figures accurate to the ounce, but from all indications we have, about 15 lb of powder metallurgy parts are going into the average passenger car built this year."

Much of the increased use of powder metallurgy parts is in iron powder components, which are almost always specified for structural use. In Chrysler cars, for example, three iron-base parts have replaced extruded aluminum, machined steel and pearlitic malleable iron for the transmission kickdown lever, transmission plug and the timing chain sprocket. All three of these parts take heavy shock loads and have long-life requirements because their locations make replacement unusually difficult. In many cases of change-over to powder metal, developments in new types of iron powder alloys, and especially the new trends in processing, such as production of high density and infiltrated parts, have been responsible.

An iron powder transmission oil pump rotor, inspected after being automatically ejected from the die table of a 200-ton compacting press at Ford Motor Co., serves to illustrate the intricate forms be accomplished in the process.

Much of the reason for more widespread use of powder metallurgy parts for automotive structural applications is the successful development of new techniques for producing high-strength iron powder parts and powder metallurgy parts with selective properties. Extremely high physical and mechanical properties now are available through use of "infiltrated" or high-density iron powder parts. Infiltration of iron skeletons by copper or brass, for example, gives higher strength and hardness values and uniform density, particularly in nonuniform or extremely heavy sections.

Advantage of these new techniques is being taken by Ford in production of a copper infiltrated sintered iron rotor used in the transmission oil pump drive mechanism. By switching from alloy steel bar stock, Ford has eliminated a screw-machine operation and a hobbing operation. Tolerances are extremely close, yet cost savings are reported substantial because of the elimination of some machining and scrap loss.

Pressed from an iron-base powder, this 30-in. ring at Chrysler Corp.'s Amplex Div. is an example of the large powder metallurgy parts that may be produced in the recently developed presses and other processing equipment.

Weighing 0.81 lb, the oil pump rotor illustrates a trend toward larger structural powder metallurgy parts.

Industry also is recognizing other attendant qualities of powder metal components. By carburizing and hardening before use, iron powder parts with tensile strengths as high as 200,000 psi are available. In production of a valve rocker arm ball in its 1959 V-8 engines, Chevrolet made use of the strength characteristic. The part must withstand compression loads up to 45,000 psi, 1800 times per minute. Because of the controlled density which allows lubricant to feed contacting surfaces under high pressure and speeds, the iron powder part was specified to replace a ball stamped from cold rolled and hardened steel.

Industry also finds that powder metallurgy affords the ability to produce tailored special alloy compositions for specific requirements. American Motors and Ford both are using a special sintered copper-lead alloy for linings of connecting rod bearings.

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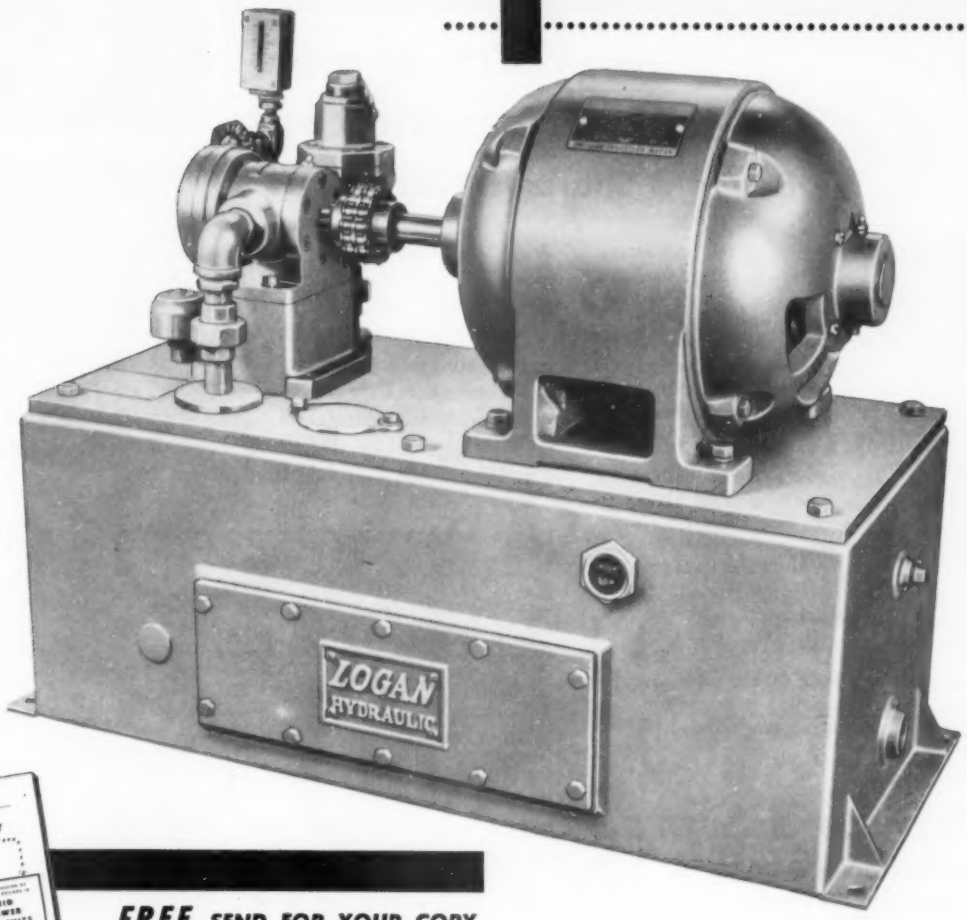

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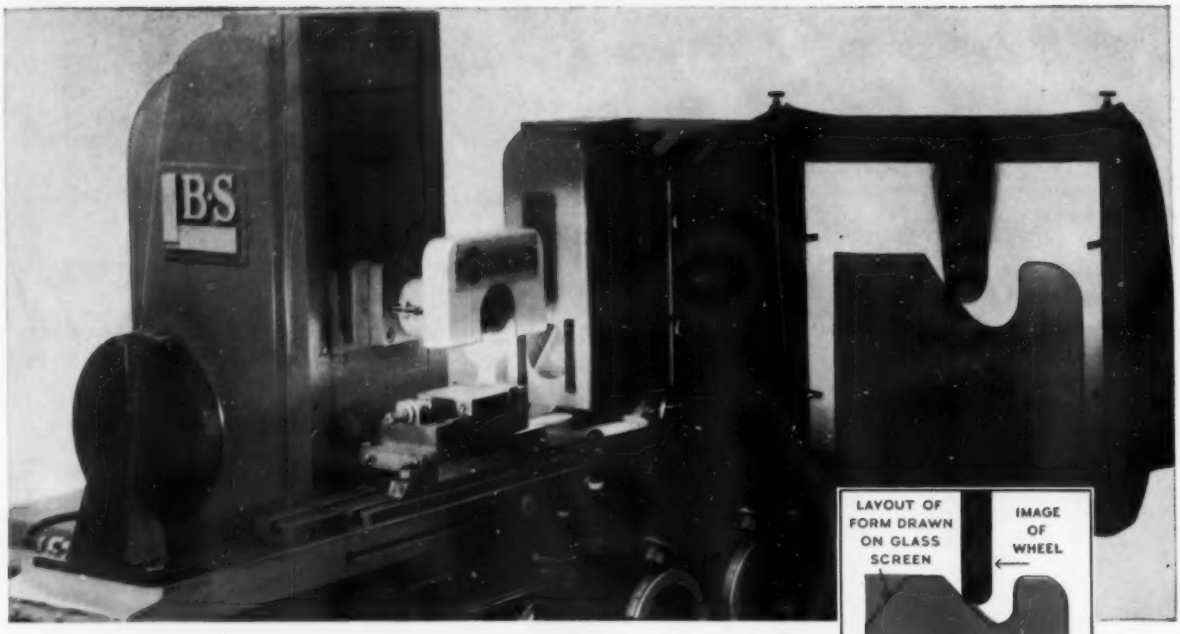

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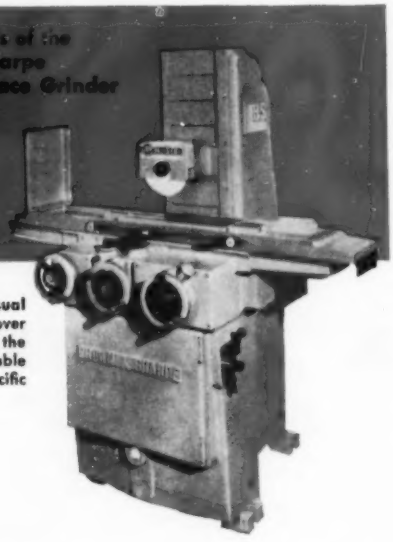

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are obtained while taking off up to 0.012 in. of tungsten carbide in a single pass. Because there is no actual contact between the wheel and workpiece, wheel wear is reduced as much as 90 percent over conventional methods.

To permit maximum efficiency in loading and unloading the work, the rotary table has wedge-shaped magnetic sections that are energized individually just before the workpieces go under the diamond wheel and de-energized immediately after pieces on the particular section leave the wheel. Speed range of the worktable is 1.7 to 12 revolutions per hour; the spindle motor is 25 hp, 1800 rpm.

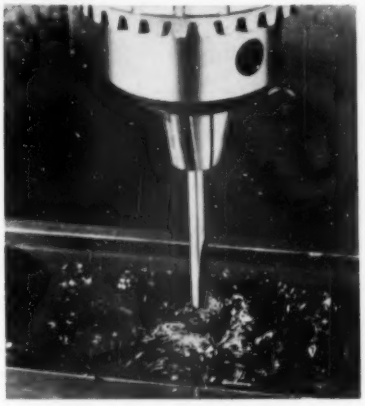
A limit switch stops rotation of the worktable if oversized stock is to be fed under the grinding wheel. Automatic stopping of the worktable is provided in the event electrolytic unit is cut out because of an overload. Automatic sizing is available as optional equipment.

Diamond wheel used by the machine is 16-in. diameter, with a 4-in. face, and a 1/16-in. depth of diamond.

Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill. **T-3-1**

Drill for Hardened Steel

A chip-cutting drill that does not risk annealing or distortion in hardened steel up to 65 R_C features a job engineered drill point and special flute form. Because the solid carbide tool does not



operate on the friction principle, there is no damage to the work.

Using a flood of water soluble coolant, this Hi-Roc drill permits a feed of up to 2 ipm in 60 R_C material.

M. A. Ford Co., Inc., Davenport, Iowa. **T-3-2**

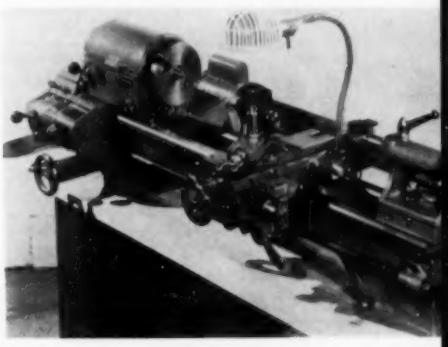
Metal-Cutting Lathe

This 10 in. metal-cutting lathe incorporates an adjustable drive and 3/4-in. collet capacity.

Available speeds range from 50 to 1500 rpm. High torque is transmitted from matched V-belts in the final drive to the spindle.

A quick change gear box provides a choice of 54 feeds or thread pitches.

The adjustable speed drive can be preset on the job to any high or low



speed limit in either direct or gear drive.

Rockwell Mfg. Co., Delta Power Tool Div., 451 N. Lexington Ave., Pittsburgh 8, Pa. **T-3-3**

Straight-Line Conveyor

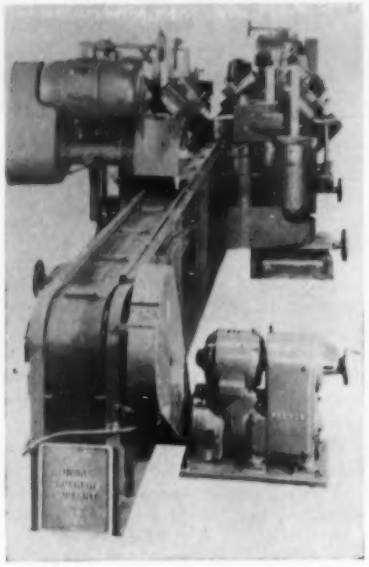
Universal straight-line conveyor for use with Type V and L polishing, buffing and brushing heads is built in sections of welded structural steel. Standard loading end section is 7 ft long, while the standard unloading end section is 6 ft long. Intermediate sections are made in 5 and 10 ft lengths. All sections are jig drilled for accuracy in bolting together.

The straight-line conveyor is available in 4, 6, 10 and 12-in. belt widths. Belt take-up and alignment adjust-

ments are provided at loading end. The 12-in. diameter pulleys are mounted in ball bearing units.

Standard conveyor height from floor to the face of the belt is 34 in. Standard riser blocks can be supplied to increase height to 40 in.

Standard control includes a magnetic starter usually mounted in a control panel with head unit starters. When



the conveyor is furnished without head units, a combination magnetic starter and a fused disconnect switch is supplied. A start-stop pushbutton station is mounted at the loading station.

Divine Brothers Co., Seward Ave., Utica, N. Y. **T-3-4**

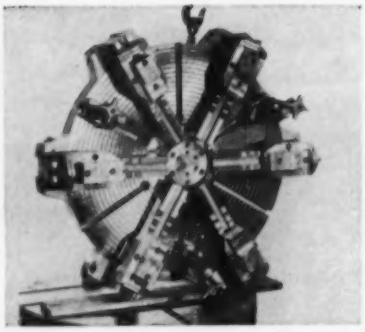
USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Universal Chuck

This 30-in. diameter universal chuck provides a control of chucking pressure exerted on the workpiece. Extra wide opening of the jaws facilitate loading and unloading, rapid setup and changeover, and accuracy.

The chuck will accommodate gears, rounds, and odd-shaped workpieces. False jaws may be made by the user to handle additional parts as necessary. The rapid-acting jaws pull the workpiece back into the chuck and against positive rest stops. Because chucking pressure can be controlled, parts may be chucked with a feather-light touch without distortion. By increasing the chucking pressure, the same chuck may also be used to round up parts which have become distorted in heat treat.

The factory calibrated chucks are



available in a range of sizes, and may be used on almost any machine having a hole through the work spindle.

Garrison Machine Works, Inc., Dayton 4, Ohio. **T-3-5**

Turbine Grinder

Single stage high-speed turbine grinder, Imp Model 7979, can be used wherever ⅛-in. shank mounted wheels or cutters can be used. For grinding, deburring, cutting or polishing, it delivers 75,000 rpm at normal 90-lb airline pressure.

Vanes of the single-stage impeller allow a straight-through flow of pressurized air, so that exhaust air can be discharged at the spindle end of the tool. This air system blows chips and particles away from the work.

The twist type throttle delivers maximum air with slightly more than a quarter turn, and will also hold any setting below maximum speed. It is recommended that the grinder be installed with an air-line filter only, so

that moisture may be removed from the air system.

Over-all length of the 7 oz tool is 4½ in.; spindle offset is 9/16 in.; air inlet is ⅛ in.; collet size is ⅛ in.

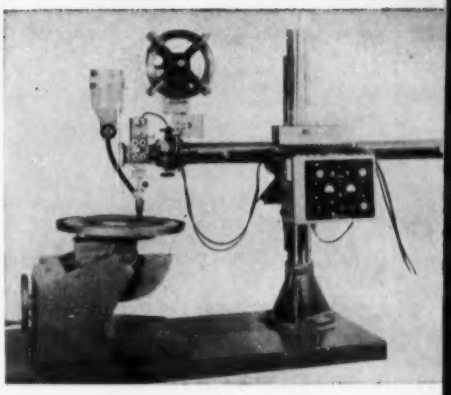
The Aro Equipment Corp., Bryan, Ohio. **T-3-6**

Automatic Welding Fixture

A vertical mast and horizontal boom mounted on the pedestal or cylindrical type base provides a flexible manipulator for automatic welding. The boom has infinite travel speeds from 10 to 150 ipm and is powered by a ¼ hp, 110 v d-c motor. Maximum clearance of the boom is 42 in., and effective weld length is 42 in. Limit switches protect against overtravel in the forward and reverse directions.

Vertical lift speed of the mast is 12 ipm through a double-worm gear-reduction gear box powered by a ¼ hp, 110 v d-c motor. The mast will pivot 360 deg and can be locked in any position. A limit switch prevents overtravel in the vertical down position.

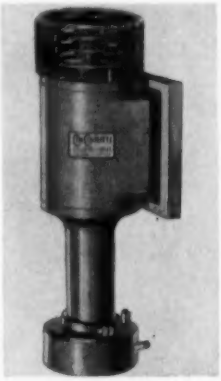
An optional control panel provides for speed control of the horizontal movement, forward and reverse switching, up and down switching, and a control power "On-Off" switch. It can be mounted on the manipulator or remotely mounted.



Miami Specialties Co., Troy, Ohio. **T-3-7**

Conversion Spindles

These electrolytic conversion spindles can be used to replace or convert existing spindles for electrolytic grinding on surface, tool and cutter, carbide tool or other grinders. They also can be applied to existing planers, milling machines, etc.



Electrolytic metal removal spindles are offered for operation up to 3000 amp in various styles and sizes.

The Cincinnati Electrical Tool Co., 368 Mt. Hope Ave., Cincinnati 4, Ohio. **T-3-8**

Stud Welding Gun

Aluminum fastener studs up to ½ in. in diameter can be welded easily to aluminum plate with this portable equipment. Resultant welds are as strong as or stronger than the studs themselves.

Aluminum studs are end-welded with the NS-10A stud welding gun, which has a special adaptor foot. An inert gas, either argon or helium, flows through the

foot and surrounds the weld area at the time of the weld. Appropriate equipment is used for metering and controlling the gas flow.

Standard studs are made from 4043 aluminum alloy, in lengths up to 3 in. and diameters of 3/16, ¼, 5/16, ⅜, 7/16 and ½ in. Tensile strength is 15,000 to 25,000 psi.

Aluminum alloys to which aluminum studs may be welded successfully include 1100, 2024, 3003, 3004, 5052, 5154, 5086, 6061 and 6063. Minimum plate thickness is ⅛ in.

Nelson Stud Welding Div., Gregory Industries, Inc., Lorain, Ohio. **T-3-9**

Testing and Sorting Instrument

Nondestructive testing and sorting of either ferrous or nonferrous metal parts can be done quickly by the Model C-2 cyclograph. It will sort raw stock, semi-finished, or finished parts by their metallurgical characteristics such as analysis, hardness, structure, case depth, etc., using an acceptable part as a "standard" in adjusting the instrument.

Using the instrument as a hand sorter, the operator watches the screen and manually discards the off-standard parts. It also can be used in conjunction with a Type 407 automatic relay unit. Parts can be passed through the test coil on a belt conveyor or by other fast feeding means. Whenever an off-standard part passes through the test coil, the relay unit sends out a reject signal that can be used to operate a solenoid operated reject gate, paint spray marking device or other reject means. The combination permits automatic, high-speed inspection.

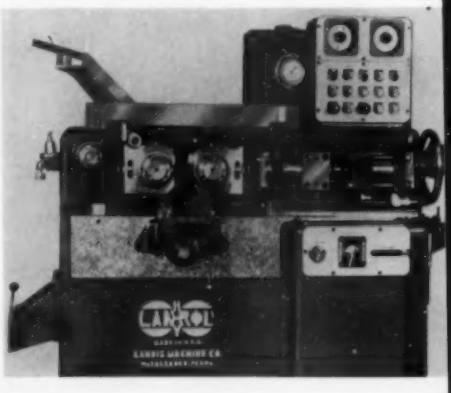
Size and shape of the part is not a particular problem as test coils are wound for any size opening.

J. W. Dice Co., Englewood, N. J. **T-3-10**

Thread Rolling Machine

Double-end studs up to 13½ in. in length can be handled by this Lanhyrol thread rolling machine. Through extended spindles, the machine will produce studs at rates of 102—⅜ to 9/16 in. and 80—⅝ in. per minute.

Parts are automatically fed into the machine from an inclined magazine, are held and carried into rolling position



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Speed-wet Metalite (GREEN-BAK) Fibre Discs

A grit 24 Metalite disc mounted on an air portable tool is removing welds from the top radius of steel washer tubs. A steel disc pad is used to back up the grinding disc.

Draw marks on the top side of this steel cooking well are being smoothed with a Metalite fibre disc mounted on a portable grinder and running at 5000 rpm.

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by an indexing workrest cage.

The segmental thread roll dies operate at a fixed center distance and are held there hydraulically. Two parts are rolled per die revolution. Upon completion of the threading operation, part drop into a conveyor and are carried out the front of the machine.

Two methods of rolling are available. The faster is by segmental or cam periphery dies with mechanical indexing for parts up to and including 5/8-in. diameter on either single or double-end work and for 3/4-in. diameter, single end only. In this range, combinations of coarse and fine pitches, left and right-hand, large and small diameters or identical threads may be rolled.

The second method is used for work larger than 3/4 in. in diameter on one end only. Plain cylindrical infeed dies are used with an automatic infeed cycle and electropneumatic indexing is substituted for mechanical indexing.

Interchanging of thread rolling dies, magazine chute rails and work carrying rings in the indexing cage make change from one diameter to another.

Landis Machine Co., Church & 5th Sts., Waynesboro, Pa. **T-3-11**

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Fastener

The Pres-Loc fastener, particularly suited for the aircraft, missile and electronic fields, can be used for securing inspection ports, modular units,

panels and all other sections requiring quick, simple installation and removal. The fasteners are easily installed and require no tools of any sort. A press of the thumb is all that is needed.

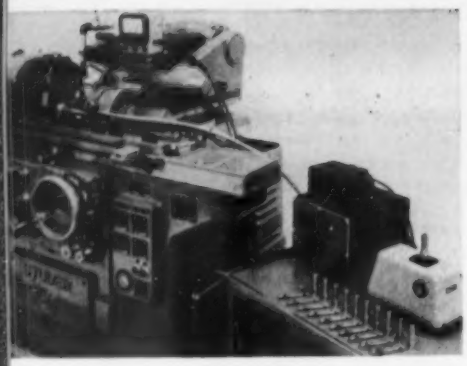
Deutsch Fastener Corp., P. O. Box 61072, Los Angeles 61, Calif. **T-3-12**

Universal Grinding Machine

Precision universal grinding machine, the Studer RHU-450 is hydraulically controlled and equipped with special electronic measuring controls. The production machine is particularly suitable for match grinding, internal and external grinding, and superfine and lap grinding.

Several electronic measuring controls are incorporated in the machine. A Movolimit electronic size control instument assures accurate grinding to a predetermined diameter from a master part or the first workpiece in the run. A Deltalimit match grinding instrument allows match grinding a shaft to fit a specific bore diameter.

Deltalimit equipment is especially effective for grinding mating parts where tolerances in the millionths are required. The finished bore is placed on the measuring arbor of the Interlimit internal measuring unit. For automatic match grinding of the shaft to the bore, the grinding machine movements are then controlled as a function of the bore



diameter and the desired, preset clearance. Any deviation in the bore from nominal diameter is automatically compensated for.

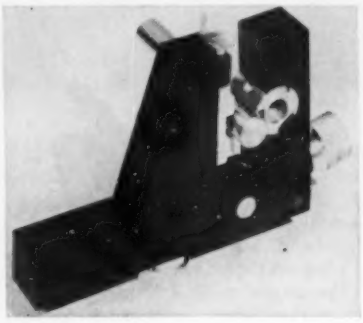
On Movolimit equipment the grinding operation is controlled automatically in relation to the workpiece diameter, independent of grinding wheel wear.

The Studer RHU-450 will grind workpieces up to 18 in. between centers with 8 in. swing. Workspindle speed is infinitely adjustable from 30 to 650 rpm.

Cosa Corp., 405 Lexington Ave., New New York 17, N. Y. **T-3-13**

Honing Tool

Developed for low-cost production work, this honing tool can be set up on any lathe, drill press or grinder. It



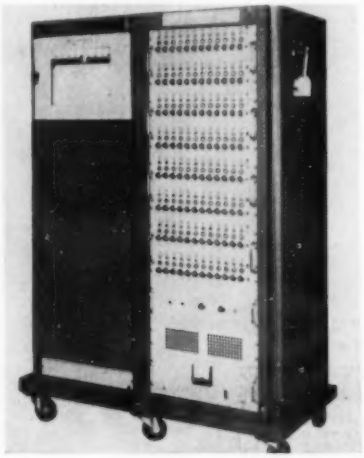
handles work in the ranges of 1/10 to 2¾ in. Stones are available in various sizes and grades.

M. Dudgeon Co., 2011 S. English, Pittsburg, Kan. **T-3-14**

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Plotting System for Strain vs Load

This strain gage recording and plotting system plots strain vs load for 24 to 96 strain gage channels on a continuous paper loop. The system can be obtained with a digital readout so that strains can be tabulated on a typewriter or punched cards or tape. The paper loop system can be run automatically, without operating the printing mechanism, for quick scanning of results. Features include individual gage factor and range selector controls for each channel. Polarity is automatically indicated and the full width of the chart paper is utilized to plot tension or compression. Scanning switch contacts are not

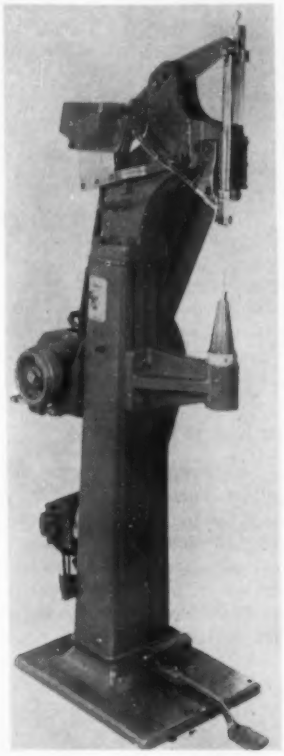


in series with the gages and contact resistance has no effect on accuracy. Light signals notify the operator when to advance range selector switches. Shorting or grounding of a gage or open circuits does not adversely affect other channels.

B & F Instruments, Inc., 3644 N. Lawrence St., Philadelphia 40, Pa. **T-3-15**

Riveting Machine

Model 95DP riveting machine will automatically feed and set semitubular and full tubular rivets up to 0.260 in. body diameter and 2⅝ in. length. It has a 10-in. throat, blade hopper and a choice of 4¼ or 5 13/16-in. stroke. Center-hung clamping type jaws are equipped with rigid arms and secondary leaf springs to control and hold



the rivet securely. A standard pair of jaws will handle any 0.260-in. diameter rivet from 1 to 3 in. in length regardless of head diameter. Because the clamping action does not take place until the riveting cycle has been actuated, the rivet hangs free so that it can be pushed aside when added clearance is needed.

For strength and rigidity, a standard post supports the anvil, large spindle and jaw carrier, and provides full utilization of available stroke.

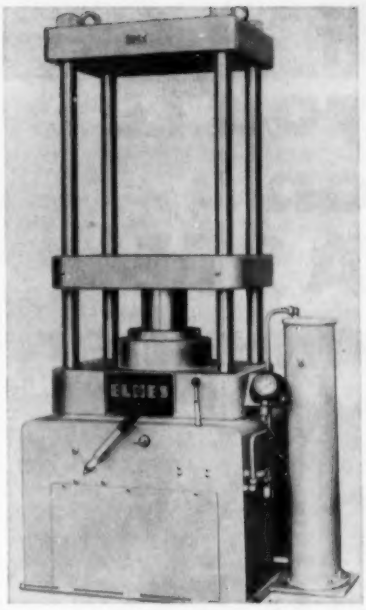
The machine can be modified to feed and set rivets up to 5⅜ in. long when equipped with auxiliary feeding parts such as pull-down anvil pin, hinge post and special hopper. Interchangeable brackets and posts are available to accommodate parts with unusual clearance requirements. An easy-trip treadle together and single-revolution nonrepeat clutch simplify operation.

Tubular Rivet and Stud Co., Quincy 70, Mass. **T-3-16**

Hydraulic Press

This air-powered hydraulic press, called Hydrolair[R], is suitable for small-production work, testing and research applications in the fields of plastics molding, laminating, compacting, assembly, etc. The unit has neither motors nor pumps—power is taken direct from the regular shop air line or small air compressor.

A double-acting ram provides a stripping force necessary in certain molding applications utilizing multiple-cavity molds of more than average depth. Extra long press columns provide a greater opening between the press platen and tophead as required for operation of the double-acting ram. Two Elmes air-hydraulic intensifiers are incorporated



to meet requirements of the double-acting ram.

The manually operated press has 125-ton pressure capacity and 15-ton stripping capacity, using a shop-air pressure

from approximately 70 to 90 psi.

Standard model Hydrolairs are built in 30, 50, 75 and 100-ton capacities equipped with manual control, available with or without hot plates. The standard 50-ton model is also available with electric pushbutton control.

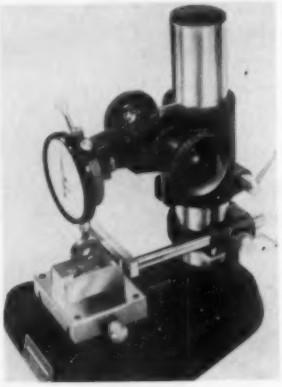
American Steel Foundries, Elmes Engineering Div., 1150-Z Tennessee Ave., Cincinnati 29, Ohio. **T-3-17**

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Comparator

This Model A comparator can be supplied with any of the 67 Em-re dial indicator models, or supplied alone, can be equipped with an adapter to accommodate any dial indicator with conventional back.

Coarse adjustment is made by sliding the indicator mount up and down the column and clamping in position. Fine adjustment is then made by rotating the left-hand knob in either direction and locking in position. The stage is



adjustable and reversible from front to back and by rotating 90 deg from side to side. It also has a 3/8-in. hole for mounting post type anvils. The Model A anvil can be rotated 90 deg.

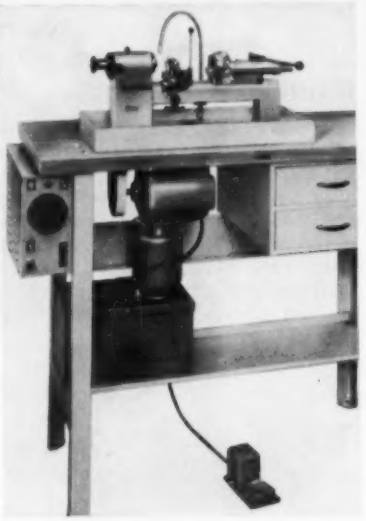
The standard comparator is equipped with a 1¾-in. diameter column with 3⅜-in. clearance between column and contact point. Vertical capacity above anvil is 3⅝-in. Other models also are available with 5⅝ and 7⅝-in. vertical capacities.

Petz-Emery, Inc., Pleasant Valley, N. Y. **T-3-18**

Instrument Lathes

Designed for production, instrument and tool work, this heavy-duty plain and turret instrument lathe is made with enclosed head stock, V-belt drive and tubeless adjustable speed control. The spindle is made for collets with either 3/16 or 5/16-inch capacity clear through. Belt changes can be made without disassembling the head stock.

Motor control provides stepless, speed changes from 0 to 4000 rpm, with dynamic braking as an inherent feature. Starting and stopping is by means of a

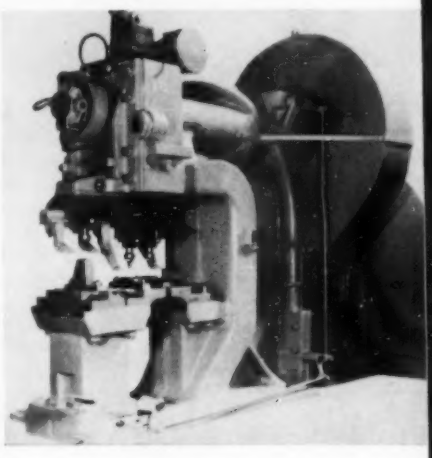


foot switch which will also control a coolant pump when it is used. Any accessories presently used on Levin lathes will also fit this model.

Louis Levin & Son, Inc., 3610 S. Broadway, Los Angeles 7, Calif. **T-3-19**

Punching Machine

This IG beam punching machine is capable of piercing two 1-in. holes through maximum metal thickness of 1 in. to accommodate the flange and web of standard 6 to 24-in. I-beams. Designed to punch structural steel shapes in both web and flange, it also can be used in plate work. Equipped



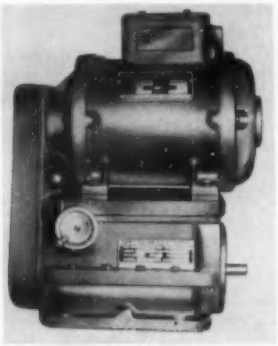
with one high and two low die holders and three gaged punching attachments, this die block has two dies of different diameters, permitting the punching of holes to close centers.

Throat depth is 24 in. and the outer leg is adjustable. Sliding head and bolster block are T-slotted for easy adjustment of head gaged attachments from minimum to maximum pitch. The machine also can be equipped for flue hole punching, notching, coping as well as shearing angles, plate or bars.

The Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio. **T-3-20**

Speed Drive with Motor

Reversing is independent of speed control on this hydraulic adjustable speed drive with motor. Rotation of a handwheel provides infinite speed control from 0 to 750 rpm. A reversing lever provides immediate rotational



change. The hydraulic unit is self-contained in an aluminum oil reservoir.

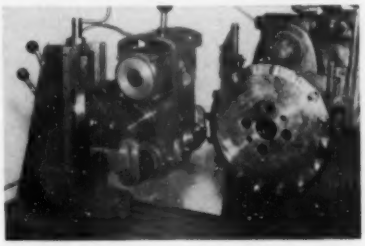
The 1½ hp electric motor is available in either 3 phase 60 cycle 220 v, or single phase 60 cycle 220 v capacitor types.

Roberts Mfg. Co., 849 W. Grand, Chicago 22, Ill. **T-3-21**

Lapping Attachment for Face Milling Cutters

Fine lapped finish is restored quickly to blades of face milling cutters with a lapping attachment that bolts directly to the machine. The setup allows an operator to obtain easily a true relationship between spindle and cutter relative to movement of the machine table surface and the face of the cutter. Lapping operation takes place on the machine without the setting being altered, thus minimizing idle time. Because it is portable the attachment can be moved from one machine to another quickly.

The attachment is available as a single wheel unit. It is designed to permit the lapping wheel to be fitted at either end of the spindle to allow lapping to be done in any position within limits of the attachment when used on vertical or horizontal single-spindle milling machines. A separate wheel and index-



ing box can be provided to convert the attachment into a more universal one for use on duplex or multispindle machines.

The vertical column, built for extra stability, permits easy vertical adjustment of the wheelhead to any height within its range. The swivel head can be set in a vertical or horizontal position and can be adjusted to a maximum of 10 deg either side of the horizontal or vertical position to achieve proper clearance angle on the cutter blade. A micrometer dial adjustment on the spindle quill governs feed of the lapping wheel.

The attachment, which is suitable for lapping most makes of inserted blade face milling cutters, is designed to cover a broad range of machines. Capacity can be increased by using simple packing blocks.

Alfred Herbert Ltd., P. O. Box No. 30, Edgwick Works, Coventry, England. **T-3-22**

Centrifugal Clutch

A cam type centrifugal clutch uses a moderate camming or locking-in action that permits it to disengage at approximately the same speed with which it engages, with or without load. Primarily it is for applications that have high operating speeds or medium pulsating loads. It affords quick release where necessary, and is particularly suitable for applications where gradual engagement is required or in operations starting from high inertia.

In motor applications, it provides a low-line voltage protection because necessary starting current is greatly reduced.

When used with gasoline engines, the centrifugal clutch provides no-load starting and no-load idling where con-

stant loading is not desired.

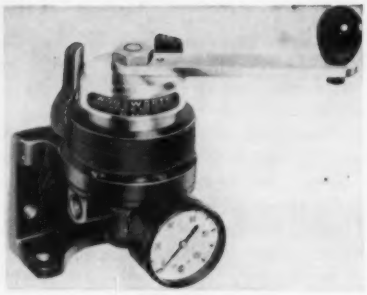
The cam type centrifugal clutch is available in 1 to 30 lb-ft capacities, with rpm from 1200 to 3600, 4¼-in. OD, 7/16 - 1 in. diameter bore.

The centrifugal clutch line can be adapted to pulley, sprocket, gear or coupling type drives mounted on either the driving or driven member. With drive mounted on driven member, clutch may be used as a power take-off.

Fairbanks, Morse & Co., Magneto Div., Beloit, Wis. **T-3-23**

Differential Air Control

Recently introduced model of the differential air control, used in conjunction with the company's chucks and air-operated Tork-Lok arbors, increases or decreases clamping pressure during the machining cycle to control distortion. Two preselected pressures are used: one adjustable pressure to operate the air devise, as for loading; the other adjustable pressure to regulate the amount of air released when clamping the part. Difference between the two pressures is the true pressure applied to the work.

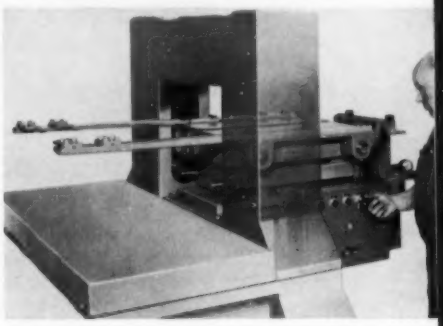


N. A. Woodworth Co., 1300 E. Nine Mile Rd., Detroit 20, Mich. **T-3-24**

Press Attachment

An accessory called Trans-Feed converts any single-action press into a transfer feed press. The unit will feed strip stock or parts into and out of die areas automatically, and can feed material between dies in a press or transfer and feed two or more presses in a line.

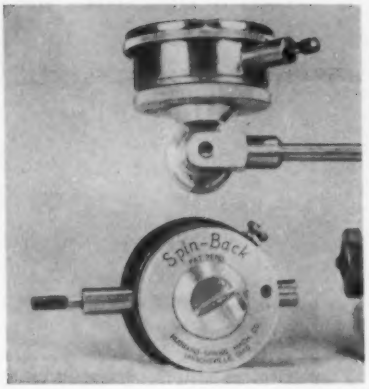
The cast aluminum accessory bolts on the press bolster plate and can be moved from one press to another to automate job-lot pressroom operations. Air cylinders, operating through ball bearing linkages, control all movements. All JIC standard electric controls for the Trans-Feed cycle are enclosed in a pushbutton panel on the side. A plug in the panel permits the press controls to be tied in electrically with the Trans-Feed and causes it to operate in sequence with the press.



Press Automation Systems, 25418 Ryan Rd., Warren, Mich. **T-3-25**

Angle Positioner For Dial Indicators

The Spin-Back all angle positioner is a self-contained assembled unit which allows a dial indicator to be used where it can give visual control of machine performance. The positioner operates smoothly, provides rigidity for precision work using tenth indi-



cators, and will hold against vibration of a machine. It is compact, lightweight and nonmagnetic. An indicator can be equipped with the positioner in a matter of minutes, using a screwdriver.

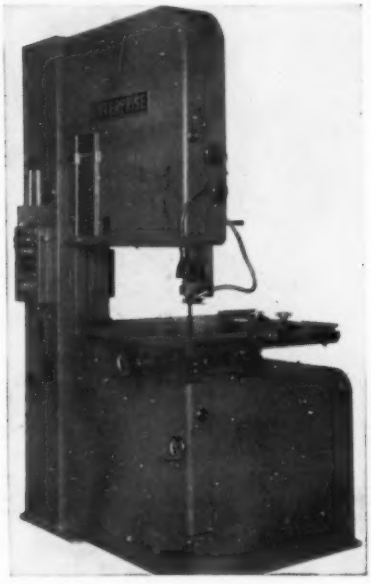
The positioner fits popular makes of indicators of the 2 to 2¼-in. dial size.

Hubbard-Spring Machine Co., 117 E. Third St., Uhrichsville, Ohio. **T-3-26**

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Multipurpose Machine

A 36-in. band sawing filing and polishing machine incorporates a tool-selector for 57 different materials and a built-in welder. The machine has foot-controlled automatic feed, and a quick tension-release mechanism that automatically and immediately adjusts blade tension. It is equipped with a separate air pump to avoid main power



waste. Controls are located on the front of the machine.

Adjustable speed drive of the metal-cutting band saw provides 35 to 6500 fpm blade speeds, and may be optionally constructed to provide a speed range of up to 15,000 fpm. Its four-speed gear box is operated from a single control.

The built-in band welder has capacity up to ¾-in., a grinder and a shear. A built-in air blower keeps the work surface clear of chips, and a chip collector is furnished. Also furnished with the machine is a cabinet for the storage of blades, attachments and supplies.

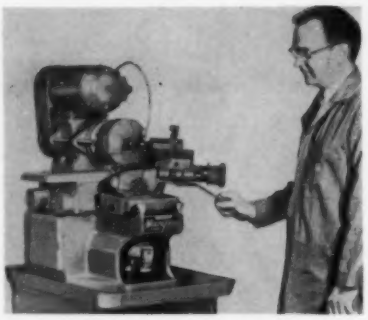
The Enterprise Co., Columbiana, Ohio. **T-3-27**

Tool Grinder

The Micropoint tool grinder allows absolute control of tool geometry when grinding single point tool profiles to precise gage accuracy, with either cone or cylindrical relief at the radius. It can handle any tool up to and including a 1-in. square shank.

Direct dial settings provide fast, accurate adjustment for each radius, cutting angle, offset and clearance in exact accordance with the geometric requirements of the tool.

Wheel spindle head of the grinder has an adjustable reciprocating movement, and the generating cycle is hand operated with a cushion at the end of the stroke, resulting in unusually long wheel life and a high finish on the tool.



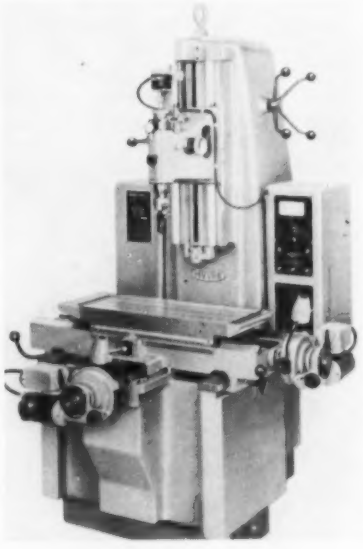
The Micropoint grinder also provides geometrically correct constant relief, more pieces per tool grind, excellent finish and uniformity of parts. Once set up, any grinding operation can be repeated with no loss in accuracy.

DeVlieg Machine Co., Fair St., Royal Oak, Mich. **T-3-28**

Universal Measuring Machine

Motorized table positioning with accurate horizontal and cross lead screws are incorporated in this universal measuring machine. A motorized lead screw drive is offered as optional equipment.

The measuring machine, capable of measuring to one-third of ten thou-



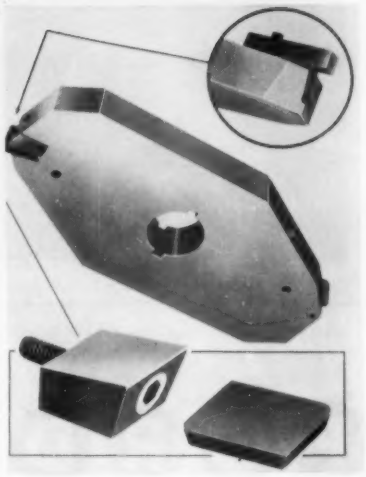
sandth, has a work capacity of 11 x 18 x 18 in. in height; choice of an electronic indicator supported on an accurate, rotatable spindle, or a universal microscope for pickup are available. A combination of rectilinear and angular positioning allows measurement of the most complex contours. Table positioning in two directions is by means of

master lead screws.

When used in combination with the Moore rotary table, the machine provides angular positioning accuracy compatible with the coordinate positioning accuracy of the machine table. The Moore Micro-Sine table extends this accuracy to compound angular settings.

In longitudinal travel, greatest error in any inch is 15 millionths; greatest error in 18 in. is 35 millionths. In cross travel, greatest error in any inch is 15 millionths, while greatest error in 11 in. is 35 millionths. Compound slide is square within 20 millionths; spindle housing travel within 50 millionths in 17 in., and spindle travel within 30 millionths in 2¼ in. The spindle axis runs true within 3 millionths.

Moore Special Tool Co., Inc., 800 Union Ave., Bridgeport 7, Conn. **T-3-29**



Microhardness Testers

Direct, accurate readings can be made within 15 seconds with the Newage Microhardness tester by measuring resistance hydrostatically. There are no microscope, conversion charts or complicated tables. Such items as small wire, tips of cutting tools, surgical needles, wire punches, surface layers, thin sheet stock and flat springs can be checked accurately. Slight vibrations do not affect the tester, which can be moved from department to department without risk of damage. The large dial is easily adjusted to facilitate comparative readings which correspond to Vickers 100 to 1000. The microhardness tester can be obtained in 1 kg or 2 kg loads penetrating as little as 0.000079 or 0.00016 in. respectively and the patented loading mechanism is designed to prevent friction and side thrust.

Newage Industries Inc., 222 York Rd., Jenkintown, Pa. **T-3-30**

Indexable Blade Flycutter

Two station positive rake flycutter for skin and spar milling applications is particularly suitable for aluminum forgings and castings.

Extra cutters are not necessary to maintain continuous operation.

Width of cut is accurately controlled by a blade setting gage that locks on side of cutter, permitting operator to set the blades in the exact position without removing the cutter from the spindle or disturbing setup.

The cutter is dynamically balanced and does not require rebalancing after indexing or replacing blades. Wedge holding power has a safety factor of 300 percent (based on a 14-in. diameter cutter at 3600 rpm).

Solid carbide indexable parallelogram blades permit cuts to a 90 deg shoulder and the case hardened wedge, located behind the blades, give unobstructed chip clearance. Wedges can be quickly and easily replaced without removing the cutters from the spindle.

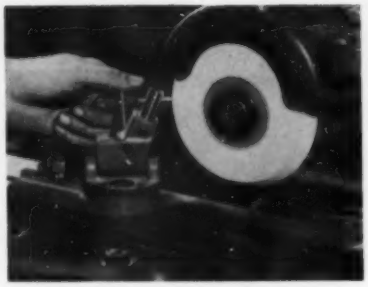
The flycutters are used for parallel, plunge or gang milling operations, in single or multiple diameter applications.

Futurmill, Inc., 6360 Highland Rd., Pontiac, Mich. **T-3-31**

Angle Dresser

This safe, angle dresser for use in tool and cutter grinding, form tools, cylindrical and surface grinding, obtains its dressing action by racking between centers. The centers are designed for

protection against dust, and have a take-up to acquire a snug feel. It can be left on the machine, because it hinges down out of way to prevent collision with the grinding wheel. The dresser with graduated base also locks in fixed position for dressing horizontally or under the wheel with the slide movements of the machine itself. A post carrying the diamond nib swivels the point in any direction and raises up and down to match the center heights



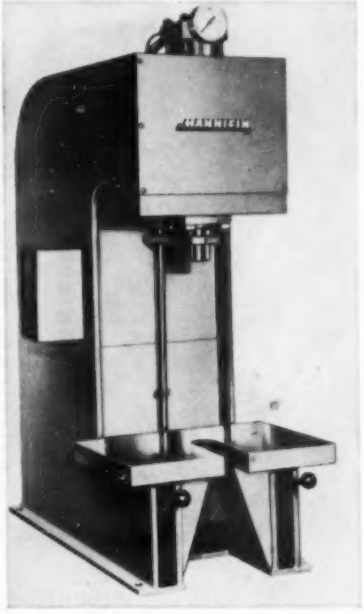
of any make of grinder. This also permits grinding or sharpening above center while diamond actually dresses at center. The dresser also lends itself to cam-roller grinding techniques, and can dress an arc in the wheel for radial relief sharpening.

The Steptool Corp., 3613 E. Olympic Blvd., Los Angeles, Calif. **T-3-32**

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Presses

These 6-ton and 8-ton high-speed hydraulic bench presses for forming, trimming and force-fit assembly operations have dual hand and adjustable down-stroke controls. Electric push-button control, with or without pressure reversal, is optionally available. Return stroke is adjustable, permitting



shortening of the work cycle until the ram just clears the workpiece on repetitive operations.

Tonnage is adjustable from 10 percent of capacity to full rated capacity. The new models can be supplied equipped with index table for automatic operation.

Specifications include a 12-in. stroke, 8-in. reach from throat of frame to center line of ram, and 18-in. gap. The 8-ton press has the following speeds: down, advance 525 ipm; down, feed 200 ipm; return, 330 ipm. Speeds on the 6-ton model are faster.

Hannifin Co., Dept. No 120, Des Plaines, Ill. **T-3-33**

Field Notes

A metallurgical control laboratory was put into operation by The Carpenter Steel Co. to provide faster service in production testing of steels to customer specifications. Dr. Carl B. Post, vice-president and technical director, estimates the new facility enables Carpenter to examine and evaluate steel in manufacture up to five times as fast as formerly was possible. All production testing is completely centralized in the new control lab on the second floor of the facility.

v v v

An ultramodern, $600,000 plant now houses the Split Ballbearing Div. of Miniature Precision Bearings, Inc. The new facility, constructed in Lebanon, N.H. will allow the division to triple its capacity and to manufacture bearings for many new applications. The brick, glass and aluminum structure was built to allow the most economical high quality manufacture. Aluminum curtain wall on three sides can be removed for expansion within a matter of days, while plant services such as electricity, water, gas etc. were installed also to allow for expansion. Air-conditioning in most areas of the plant is emphasized in the final assembly area which is equipped with a system to remove all particles larger than one micron.

v v v

Parker-Hannifin Corp. has arranged to purchase a plant in Lexington, Ky. which, until recently, was owned and operated by the Kawneer Co. of Niles, Mich. The plant has approximately 50,000 sq ft of readily usable manufacturing space all on one floor.

new companies

Sykes Machine & Gear Corp. has been organized in the United States for the distribution of the products of W. E. Sykes Limited of Middlesex, England, builders of gear making machinery. Address of the new firm is 744 Broad St., Newark, N.J.

v v v

A jointly owned company has been formed by Olin Mathieson Chemical Corp. and Textron, Inc. The new organization, known as Almetco, Inc., will produce aluminum extrusion for the two firms. It will own and operate aluminum extrusion plants formerly owned by Textron at Girard, Ohio and Nesquehoning, Pa. Almetco's production capacity will be shared equally by Olin Mathieson and Textron Metals Co., a Textron division. Olin Mathieson will not be associated with the products manufactured and sold by Textron Metals.

v v v

Robinson Plastics, Inc. was formed by Robinson Aviation, Inc. as a wholly owned subsidiary. Its function will be to design and distribute a complete line of plastic ware to meet special requirements of airline and transportation use.

new facilities

The Twin Cities sales branch office and warehouse for Crucible Steel Co. of America has been moved from St. Paul to a new building at 2911 Como Ave. S.E. in Minneapolis. Larger facilities of the new plant will permit stocking of a greater quantity of the company's alloys, tool and stainless steels.

v v v

Cleveland Cap Screw Co. has expanded its warehousing operations in both Philadelphia and Chicago. Each facility has been moved to new quarters to approximately triple its space. The shifts to larger quarters will permit fuller inventories and faster service to customers in surrounding areas. New address for the Philadelphia sales office and warehouse is 4237 N. Second St. The Chicago address is 133 S. Racine Ave.

v v v

A warehouse service center has been established under the name of Eutectic Welding Alloys-New England Div., Inc. in Boston, Mass. at 167 Brighton Ave. The facility will make available the full resources of the international welding research and development laboratories of Eutectic Welding Alloys Corp.

v v v

Crucible Steel Co. has increased its number of warehouses to 32 by adding a facility in Erie, Pa. at 1134 Payne Ave. Operating as a sub-branch of the Cleveland warehouse, the new one will serve northwest Pennsylvania, southwestern New York and northeastern counties of Ohio.

v v v

General Bearing & Supply Co. has opened a Flint-Saginaw branch at G-5266 N. Saginaw St. in Flint, Mich. The facility will carry a complete stock of all types and sizes of bearings, pillow blocks, bronze bars, bushings and lubricants.

v v v

Latrobe Steel Co. has established warehouse facilities for its line of disk forgings for the aluminum extrusion industry at McNicholas Storage, 1028 W. Rayen Ave., Youngstown, Ohio.

name changes

Union Carbide Corp. changed the name of its metals division from Electro Metallurgical Co. to Union Carbide Metals Co. The altered name is in line with the company's program to identify all of its divisions more closely with the parent corporation.

v v v

Relton Corp. is the new name for the company formerly identified as Termite Drills, Inc. According to the company announcement, the name change was dictated because of diversification of products now being manufactured by the company.

association news

A four-page news leaflet has been set up for bi-monthly publication by the Gray Iron Founders' Society, Inc. Intended to help designers and engineers in specifying and designing gray iron castings, the new *Designers Digest* will carry illustrations and descriptions of casting that have been redesigned from competitive materials and also will give up-to-date tips on casting design, properties and on ways to reduce casting costs. Distribution to engineers and purchasing agents is through gray iron suppliers or from the Gray Iron Founders' Society.

v v v

Authoritative English cover-to-cover translations of four leading Soviet journals have been sponsored by the Instrument Society of America under grant-in-aid from the National Science Foundation. The project is calculated to provide answers to the questions of what the Russians are doing in the field of instrumentation, how much we know of their activities and scientific achievements. The four translated publications include *Measurement Techniques, Instruments and Experimental*

Techniques, Automation and Remote Control and *Industrial Laboratory*. Subscription information is available from ISA, 313 Sixth Ave., Pittsburgh.

V V V

A study of essential differences between the Machine Tool Electrical Standards and those of the Joint Industry Conference has been completed by NMTBA's Electrical Standards Committee. The four-page report lists and describes 49 basic difference between the two electrical standards. Copies are available from the Association, 2071 E. 102nd St., Cleveland 6, Ohio.

research

An 18-month study project is under way by The University of Michigan Institute for Social Research on how America can make better use of its scientists and engineers. The study being conducted under a $67,000 grant from the Carnegie Corp. of New York, will supplement and extend research conducted in this area by the Institute since 1952.

corporate changes

Directors of both Eaton Mfg. Co. and Cleveland Worm & Gear Co. have approved a transaction whereby Eaton acquires Cleveland Worm & Gear and its wholly owned subsidiary, Farval Corp. The acquired company is now being operated as a wholly owned subsidiary of Eaton under guidance of its former management. No changes in personnel, products or sales policies are in prospect.

V V V

Purchase of The Jes-Cal Co. was announced by National Automatic Tool Co., Inc. which plans to develop, build and sell a machine to utilize the size control honing tools made by Jes-Cal. Manufacture of the honing tools will continue at the Fraser, Mich. plant and they will be shipped to Natco's plant in Richmond, Ind. for installation in the machines to be manufactured. Former co-owners of Jes-Cal, F. J. Jeschke and G. M. Calvert, will remain with the company as vice-presidents. Both men are members of ASTE's Detroit chapter.

V V V

The Vernon, Calif. plant of U. S. Industries, Inc. was sold to Bethlehem Pacific Coast Steel Corp. at a price reported in excess of $1-million. The 290,000 sq ft plant formerly occupied by the Axelson Div. of USI, and also was used for certain operations by the Clearing and Western Design divisions.

Osco Steel Co. recently purchased a division of Detroit's Solar Steel Corp. The transaction involved the complete warehouse inventory with the exception of flat rolled products. This is the second expansion step taken in a short time by Osco, which also purchased a former Murray Corp. of America plant in Detroit. A remodelling program costing an estimated $500,000 already has been started on this property.

V V V

Acquisition of Griscombe Products, Inc. was announced by Eugene Dietzgen Co. The company, which is a designer, manufacturer and holder of numerous patents on micro-filming equipment, will be identified as the Griscombe Products Corp., subsidiary of Dietzgen.

new divisions

The L. S. Starrett Co. has established a new gage division with manufacturing engineering and sales facilities to design and build complete special gaging equipment. The division is set up to offer counsel on special gaging problems and will manufacture tailor made gages to meet specific requirements.

V V V

Markem Machine Co. has established a new division for the mechanical industries with Spencer M. Wright as manager. The division will be responsible for sales and service of the company's products to manufacturers.

V V V

An Industrial Div. was created by American-Standard the first of the year through consolidation of the American Blower, Kewanee Boiler and Ross Heat Exchange Divs. The new division is continuing to manufacture and market the same products made by the three separate divisions.

moves

Manufacturing facilities of the Branford Co. have been transferred from New Haven to New Britain, Conn. New address is 132 Glenn St.

V V V

Larger quarters are provided the Chicago branch of The L. S. Starrett Co. in its new sales office and warehouse building at 4949 W. Harrison St.

V V V

Location of the Portland, Ore. Branch office of Charles Bruning Co., Inc. has been changed to 2136 S.W. Fifth Ave. to provide larger offices, display room and warehouse facilities.

who's meeting and where

Mar. 9-10. STEEL FOUNDERS' SOCIETY OF AMERICA. 57th annual meeting, Drake Hotel, Chicago, Ill. Get complete data from society headquarters, 606 Terminal Tower, Cleveland 13, Ohio.

Mar. 11-12. AMERICAN SOCIETY OF TOOL ENGINEERS. Seminar on Analysis of Metal Cutting Methods, Bond Hotel, Hartford, Conn. For details, contact Society headquarters, 10700 Puritan Ave., Detroit 38, Mich.

Mar. 11-12. NATIONAL INSTITUTE OF MANAGEMENT, INC. Seminar on Production control, Sheraton-Gibson Hotel, Cincinnati, Ohio. More information is available from institute office, Suite 1419, National City Bank Bldg., Cleveland 14, Ohio.

Mar. 11-12. INSTRUMENT SOCIETY OF AMERICA, Pittsburgh Section. 9th annual iron and steel conference, Pittsburgh, Pa. More information may be obtained from society office, 313 Sixth Ave., Pittsburgh 22, Pa.

Mar. 11-13. PRESSED METAL INSTITUTE. 10th anniversary spring technical meeting, Pick-Congress Hotel, Chicago, Ill. Obtain more facts from institute headquarters, 3673 Lee Rd., Cleveland 20, Ohio.

Mar. 16-20. SOCIETY OF AUTOMOTIVE ENGINEERS. Meeting on passenger car, body and materials will include Production Forum on Mar. 19 and 20; Sheraton-Cadillac Hotel, Detroit, Mich. For details contact society office, 485 Lexington Ave., New York 17, N. Y.

Mar. 16-20. AMERICAN SOCIETY FOR METALS. 11th Western metal exposition and congress, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles, Calif. For details, write society office, 7301 Euclid Ave., Cleveland 3, Ohio.

Mar. 30-Apr. 3. SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS and SOUTHWEST RESEARCH INSTITUTE. Short course in strain gage techniques, San Antonio. All facts are available from Dr. M. M. Lemcoe, Southwest Research Institute, Box 2296, San Antonio 6, Texas.

Mar. 25-27. SOCIETY OF THE PLASTICS INDUSTRY, Pacific Coast Section. 16th annual conference, Hotel del Coronado, San Diego, Calif. Further information can be obtained from Earl R. Rountree, conference publicity chairman, 961 E. Slauson Ave., Los Angeles 11, Calif.

Mar. 26. AMERICAN SOCIETY FOR QUALITY CONTROL, Rochester Section. 15th annual quality control clinic, University of Rochester, Rochester, N. Y. For details, contact Earl D. Hogan, Eastman Kodak Co., Kodak Park Works, Engineering Div., Bldg. 23, Rochester 4, N.Y.

Mar. 22-25. UNIVERSITY OF CALIFORNIA and PURDUE UNIVERSITY. Joint conference on numerical control of machines in production processes, presented by the two schools of engineering on campus of University of California, Los Angeles. Contact dean of engineering, UCLA, for details.

Mar. 31. AMERICAN SOCIETY OF TOOL ENGINEERS. Seminar on tooling for metal powder parts, La Salle Hotel, Chicago, Ill. Details are available from Society office, 10700 Puritan Ave., Detroit 38, Mich.

Mar. 31-Apr. 2. AMERICAN POWER CONFERENCE, sponsored by Illinois Institute of Technology with cooperation of various colleges, and universities and pro-

fessional societies. Hotel Sherman, Chicago, Ill. Direct inquiries to Conference Director, R. A. Budenholzer, Mechanical Engineer Dept., Illinois Institute of Technology, 3300 Federal St., Chicago 16, Ill.

Apr. 7-10. PURDUE UNIVERSITY and UNIVERSITY OF CALIFORNIA. Joint conference on numerical control of machines in production processes, presented by the two schools of engineering on Purdue campus. For more data write to dean of engineering at Purdue, West Lafayette, Ind.

Apr. 7-8. UNIVERSITY OF WISCONSIN, University Extension Div. Engineering institute on Industrial product design. Write Dept. of Engineering, University Extension Div., University of Wis., Madison 6, Wis. for more data.

Apr. 8-9. UNIVERSITY OF ILLINOIS. 2nd annual seminar in engineering drawing sponsored by department of general engineering and Division of University Extension. Obtain details from university, Urbana-Champaign, Ill.

Apr. 9-10. AMERICAN SOCIETY OF TOOL ENGINEERS. Seminar on analysis of metal cutting methods, Benjamin Franklin Hotel, Philadelphia, Pa. Get other data from Society office, 10700 Puritan Ave., Detroit 38, Mich.

Apr. 10-12. UNIVERSITY OF WISCONSIN, College of Engineering. Engineering exposition held on university campus. Further facts may be obtained from the university, Madison 6, Wis.

Apr. 13-15. AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Hydraulic Division conference, University of Michigan campus, Ann Arbor, Mich. Contact society headquarters, 29 W. 39th St., New York 18, N.Y. for all details.

Apr. 18-22. AMERICAN SOCIETY OF TOOL ENGINEERS. Annual meeting, Schroeder Hotel, Milwaukee, Wis. All details are available from Society office, 10700 Puritan Ave., Detroit 38, Mich.

Apr. 22-26. METAL TREATING INSTITUTE. Annual spring meeting, Hollywood Beach Hotel, Hollywood, Fla. More information is available from institute headquarters, 420 Lexington Ave., New York 17, N.Y.

Apr. 28-29. UNIVERSITY OF WISCONSIN, University Extension Div. Engineering institute on industrial applications of X-ray diffraction techniques. Obtain more information from Dept. of Engineering, University Extension Div., University of Wiscoinsin, Madison 6.

.....readers' viewpoints

. . . surface plate specifications

To the Editor:

Regarding the letters by Messrs. Rahn and Moody published in your Readers' Viewpoint section of the December issue, we would also like to express our opinion on surface plate flatness. We agree with Mr. Moody that current surface-plate flatness specifications should be revised so that present instances of misinterpretation would be eliminated. However, we do not agree with the methods of revision that are advocated by Mr. Rahn.

The method that Mr. Rahn advocates misses the point entirely. It does not give a surface flatness tolerance which is the basic reason for checking a surface plate in the first place. His method gives a check of surface consistency but no indication of surface flatness.

The fallacy in Mr. Rahn's argument concerns repeat readings. This is inaccurate because any consistent surface will give repeat readings any place on that surface no matter whether it is flat or curved. Even a ball will give repeat readings if the surface of that ball is a consistent curve!

We have many years of experience and have found that optical checking with the autocollimator and the Griswall level are two of the most accurate and convenient ways to read surface flatness. We think Mr. Moody and Mr. Rahn will agree that this is an accurate method, as the autocollimator will give readings of less than one millionth inch.

These are expensive instruments and not everyone can afford to buy them to check the accuracy of surface plates. But if accuracy is desired, this is the best way we know of getting it. Because the instruments are expensive, we supply an autocollimator checking service to all who request it.

Who is right will be settled once and for all when the Canadian Government issues a definite surface plate specification. We hope it will be soon.

Donald V. Porter
The Herman Stone Co.
Dayton, Ohio

. . . high-speed machining

To the Editor:

Somebody goofed!

I have always admired your outstanding and distinctive covers. They have been the subject of many discussions in our office.

Your January cover, however, has us amazed and chagrined. We had always considered the covers as accurate with respect to impressions created. But whoever saw chips squirting upward from the top of a lathe tool as depicted on your January cover? Did the artist go amuck and why, for heaven sake, did not the editors notice the discrepancy?

Yours for interesting and accurate covers on THE TOOL ENGINEER.

Sid Smith
Raleigh, North Carolina

ED.—Thank you for the confidence and compliments, as well as the opportunity to explain our January cover. Incidentally, we are particularly proud of this cover. It depicts high-speed testing on a lathe using a ceramic tool bit at sufficiently high speeds and proper tool geometry with sufficient back rake. The chips do squirt as illustrated on a fine cut. In fact, under such conditions, the chips can burn, leaving no trace. With heavier cuts, the chips can be extremely dangerous to operators when their path becomes uncontrolled. One experiment had chips falling against the wall 40 feet from the machine.

. . . communications

To the Editor:

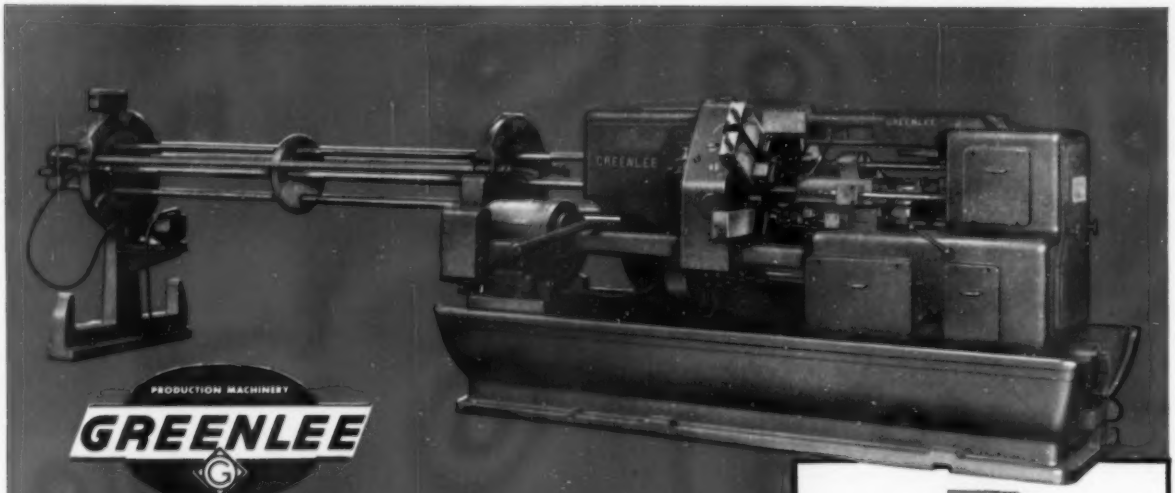
I was attracted to your editorial titled, "What's in a Name?" which appeared in the January 1959 issue of THE TOOL ENGINEER.

The ASTE East Texas chapter has already pursued this avenue by sponsoring the Texas A & M Engineering Extension training program for industrial supervisors and management people. One of the courses is "Industrial Communications."

As the instructor I think that there is one factor that should be noted. The people are aware that word meaning and usage is a problem to production. These East Texas people pull money from their own pocketbooks to attend such training that is your subject of the editorial. I think that they should be commended.

I could not help but let you know that something is being done about communications in East Texas, because we also consider it a problem. Please allow me to join you for better communciations and if I can be of any help in promoting or training, please feel free to call upon me.

Vergil B. Clark
503 Gilchrist St.
College Station, Tex.



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Removable fittings attach air lines to the stock reel tubes. A vacuum pump withdraws the piston when restocking. Push-button control panel is provided for starting and stopping.

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Feed Out Stock to 16½"

Eliminate Pushers and Feed-Out Cams

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2. Stock can be automatically air-fed to position in one or more machining stations permitting two or more pieces per cycle.
3. Multiple feed-out flexibility enables you to finish machine a variety of pieces that ordinarily demand costly second operation setups.

If you are running into production headaches on a specific job, Greenlee may be able to adapt an "Air-Feed" to solve your problem. See your Greenlee Distributor.

Write for your copy of Catalog A-405 — first step on the way to more profitable production with Greenlee Automatic Bar Machines.

• • •

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Multiple-Spindle Drilling and Tapping Machines

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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-3-172

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

A-3-165—Drilling Fixture—*Accurate Bushing Co.* Tooling suggestions for lift swing contained in Bulletin LS-58. (Page 165)

A-3-168—Reamers—*Ace Drill Corp.* New catalog describes entire line of Ace high speed steel and carbide drills, reamers, drill blanks and special drills. (Page 168)

A-3-171—Dial Comparator—*Alina Corp.* Catalog gives details of dial indicator H-20. (Page 171)

A-3-33—Carbide Tools—*Carmet Division, Allegheny Ludlum Steel Corp.* 32-page Carmet catalog contains price and specifications of carbide tools and holders. (Page 33)

A-3-202—Barrel Finish—*Almco, Queen Products, Inc.* 52-page handbook available on barrel finishing. (Page 202)

A-3-228-3—Inspection Tools—*American Cystoscope Makers, Inc.* Free copy of booklet available on Borescopes. (Page 228)

A-3-8—Drill Bushings—*American Drill Bushing Co.* Catalog and complete information available on Thinwall line of regular drill bushings. (Page 8)

A-3-12—Radial Drill—*American Tool Works Co.* Bulletin No. 325 contains facts on American 9- and 11-inch column Hole Wizard radial drills. (Page 12)

A-3-179—Metal Cutting Saws—*Armstrong-Blum Mfg. Co* Catalog C85 has complete details, facts and figures on Marvel metal cutting hack saws and band saws. (Page 179)

A-3-61—Taps—*Bay State Tap & Die Co.* Detailed information on tapping taper pipe threads available in Bay State Catalog 56. (Page 61)

A-3-200-3—Drilling Unit—Bedford Gear *& Machine Products Co.* Free catalog No. 10 describes Bedford rotorized spindle drilling unit. (Page 200)

A-3-53—Air Motor—*Bellows Co.* Bulletins ML-3 and BM-25 contain information on cutting costs with air motors. (Page 53)

A-3-14—Surface Grinders—*Blanchard Machine Co.* Copy of "Work Done on the Blanchard" and "The Art of Blanchard Surface Grinding" now available. (Page 14)

A-3-66—Surface Finish Indicator—*Brush Instruments Division.* Booklet "Control the Finish and You Control the Costs" gives details of the Surfindicator. (Page 66)

A-3-216-2—Clamps—*Carr Lane Mfg. Co.* Catalog 5 describes sizes and styles of Carr Lane fixture clamps. (Page 216)

A-3-222-2—Low-Temperature Casting Alloy—*Cerro de Pasco Sales Corp.* Engineering specifications available in Cerro Alloys Bulletin No. 8. (Page 222)

A-3-231—Reamers — *Chicago-Latrobe* — Catalog No. 58 contains data on Chicago-Latrobe cutting tools. (Page 231)

A-3-47—End Mills—*Cleveland Twist Drill Co.* Complete line of Cleveland end mills described in free informative booklet. (Page 47)

A-3-226-2 — Bore Gage — *Comtor Co.* Bulletin 50 describes Comtorplug self-centering and self-aligning precision gages. (Page 226)

A-3-190—Carbide Gages—*Arthur A. Crafts Co., Inc.* Catalog now available on Crafts carbide gages. (Page 190)

A-3-13—Boring Tools—*DeVlieg Microbore Division of DeVlieg Machine Co.* New catalog No. 58 shows applications of Microbore boring tool. (Page 13)

A-3-59—Engineering and Designing—*Ehrhardt Tool & Machine Co.* Facilities available at Ehrhardt described in free booklet "Triple Plus". (Page 59)

A-3-213—Tool Holders—*Erickson Tool Co.* Applications of Erickson holding tools described in Catalog K. (Page 213)

A-3-185-1 — Cathetometers — *Gaertner Scientific Corp.* Bulletins 188-53 and 194-57 describe the Gaertner coordinate cathetometers. (Page 185)

A-3-172—Automatic Bar Machine — *Greenlee Bros. & Co.* Complete information on Greenlee automatic bar machines available in Catalog A-405. (Page 172)

A-3-180—Brazing Alloys—*Handy & Harman*—Technical bulletins T-1 and T-2 give general characteristics of silver brazing alloys plus the compositions. (Page 180)

A-3-5—Lathes—*Hardinge Brothers, Inc.*—Bulletin HLV contains information on tool room and production lathe featuring infinite control of speed and feed. (Page 5)

A-3-IFC—Drill Unit—*Heald Machine Co.* Bulletin No. 5-2, Issue 1, has complete detail on self-contained unit for rotating and feeding single or multiple tools in automated setups. (Page inside front cover)

A-3-200-1—Coolant Filters—*Infilco, Inc.* Bulletin 9020 tells how the "Impinjo" filter cleans coolants. (Page 200)

A-3-149—Hydraulic Power Devices—*Logansport Machine Co., Inc.* 32-page manual has data on fluid power circuits revised to current engineering trends. (Page 149)

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A-3-46—Dial Indicators—*Lufkin Rule Co.* Complete information on Lufkin dial indicators in Catalog No. 51. (Page 46)

A-3-28—Carbide Tooling—*Metal Carbides Corp.* Catalog 56-G has complete engineering data and description of carbide tools and holders. (Page 28)

A-3-222-3—Drill Bushings—*W. F. Meyers Co., Inc.* Information available on Meyco carbide inserted drill bushings in catalog No. 42. (Page 222)

A-3-177—Phosphor Bronze—*Rolling Mill Division, The Miller Co.* Free catalog describes uses for Miller 200-plus phosphor bronze. (Page 177)

A-3-67—Subland Drills—*Mohawk Tools, Inc.* 12-page illustrated catalog shows the multiple advantages of drilling and chamfering with Subland Drills. (Page 67)

A-3-72—*Thread Rolling Head—The National Acme Co.* Cost-reducing ideas showing how to use Acme-Fette thread rolling heads on present equipment in Bulletin NAF-57A. (Page 72)

A-3-29—Cutting Tools—*National Tool Co.* New 92-page catalog shows National Tool's complete line of special tools for the metal-working industry. (Page 29)

A-3-186—Four-Slide Machines—*The A. H. Nilson Machine Co.* Nilson General Catalog available on automatic 4-slide equipment. (Page 186)

A-3-58—Metal Cleaning—*Oakite Products, Inc.* 16-page illustrated booklet "Cleaning and Preparing Metal in Aircraft Production" now available. (Page 58)

A-3-43—Hydraulic Cylinder—*Ortman-Miller Machine Co.* Description drawings of cylinder mountings and capacity chart described in Bulletin No. 105. (Page 43)

A-3-164—Hydraulic Press—*Hannifin Co.* Details on Hannifin "FD" presses available in Bulletin 132A. (Page 164)

A-3-159—Dial Indicators—*Petz-Emery, Inc.* Complete line of Em-re dial indicators shown in Catalog DD. (Page 159)

A-3-230-3—Tool Components—*PIC Design Corp.* 32-page catalog and plastic tool design templates available on all stainless steel precision tool components. (Page 230)

A-3-221—Tube Bending Machinery—*Pines Engineering Co.* Copies of "Pines News" have latest data on rotary and press-type machine including tooling information. (Page 221)

A-3-193—Thread Rollers—*Reed Rolled Thread Die Co.* Bulletin B-2 has information on thread rolling attachment. (Page 193)

A-3-68—Hydraulic Valves—*Rivett, Inc.* Valve catalog No. 210 has complete information on performance, ratings, dimensions, mountings and ordering instructions for Rivett hydraulic valves. (Page 68)

A-3-166—Clutches—*Rockford Clutch Division, Borg-Warner Corp.* Bulletin shows typical installations and applications of Rockford clutches and power take-offs. (Page 166)

A-3-157—Expanding Chucks—*Speedgrip Chuck Division.* Bulletin No. 27 has full description and technical details on Speedgrip expanding locators. (Page 157)

A-3-65—Surface Grinders—*Thompson Grinder Co.* Truform grinders described in Catalog T558. (Page 65)

A-3-74—Portable Power Tools—*Thor Power Tool Co.* Free book "Automation in Assembly" gives complete story of Thor multiples. (Page 74)

A-3-176—Air Cylinders—*Tomkins-Johnson Co.* Bulletin No. SQ 10-58 and complete details available on the T-J squair head air cylinders. (Page 176)

A-3-70—Spring Steel—*Uddeholm Company of America, Inc.* Spring Steel stock list and general catalog now available. (Page 70)

A-3-69—Tool and Die Steel—*Universal Cyclops Steel Corp.* Descriptive brochure No. TS-101 gives specifications on LO-Air low temperature air hardening tool and die steel. (Page 69)

A-3-235—High Speed Steel—*Vanadium-Alloys Steel Co.* Technical data sheet contains complete information on Vasco M-2. (Page 235)

A-3-146—Cutting Tools—*Vascoloy-Ramet Corp.* Facts about all types of Tantung tools including examples of production cost-savings in Booklet No. 573. (Page 146)

A-3-211—Retaining Rings—*Waldes Kohinoor, Inc.* 24-page catalog RR 10-58 shows solutions to design problems using Waldes Truarc retaining rings. (Page 211)

A-3-44—Punch Press—*Wiedemann Machine Co.* Bulletin 301 has data on the Wiedemann turret punch presses. (Page 44)

A-3-195—High-Speed Movie Camera—*Wollensak Optical Co.* Complete information and prices on the WF-3T Fastax available in bulletin No. WF-3T. (Page 195)

A-3-183-1—Rotary Slitters—*The Yoder Co.* Illustrated book describes Yoder slitter equipment. (Page 183)

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Trade Literature

for free booklets and catalogs—use request card, page 173

Miniature Clutches

Miniature one-way precision roller clutches described in detail in brochure covering design features, applications and advantages. The Miniclutch Co., 373 Morse St., Hamden, Conn. **L-3-1**

Plant Modernization

Extensively illustrated, 20-page brochure, "59 Ideas for Modernization in '59," points out various possibilities for modernization in both large and small ways. Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1, Wis. **L-3-2**

Cutting Tools

Twelve-page catalog pictures and describes complete line of standard and special high-speed steel cutting tools for toolroom and production use; includes several styles of Woodruff keyseat cutters, milling cutters and slitting saws; has accompanying list price. Quality Tool Works, 760 S. Market St. Waukegan, Ill. **L-3-3**

Count Control

Schematic drawings illustrate 14-page brochure describing Countron automatic count control outlining its features, specifications and operation; discusses in some detail its application and advantages. Hobson Miller Machinery Corp., 280 Lafayette St., New York 12, N. Y. **L-3-4**

Adhesives, Coatings and Sealers

Well illustrated 12-page catalog describes design concepts, typical applications and general characteristics of various adhesives, coatings and sealers. Adhesives, Coatings & Sealers Div., Minnesota Mining & Mfg. Co., 900 Bush Ave., St. Paul 6, Minn. **L-3-5**

Press Safety

Informative 96-page handbook, "Power Press Safety Manual," covers power presses from basic construction to maintenance, with chapters on why a power press guarding program is necessary, functions on power press parts, training, maintenance and automation; well illustrated by photos and drawings. National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill. **L-3-6**

Rivets

Revised 34-page catalog presents line of rivets and riveting tools; each type described, pictured in engineering drawing, and discussed as to use and application. Hi-Shear Rivet Tool Co., 2600 W. 247th St., Torrance, Calif. **L-3-7**

Tube Bending

Consensus benders for critical bending of thin wall, high strength alloy tube presented in pictorial 20-page booklet emphasizing important features and advantages of line. Wallace Supplies Mfg. Co., 1300 Diversey Parkway, Chicago 14, Ill. **L-3-8**

Forging

Extensively illustrated 24-page brochure covers all phases of company's forging facilities and range of products; special section deals with forging problems and solutions separated according to markets. The Park Drop Forge Co., E. 79th St. and Buck Ave., Cleveland 3, Ohio. **L-3-9**

Heat Treating

Simplified chart allows user to relate application requirements to furnace and atmosphere equipment; lists major heat treating categories including annealing, brazing, carbonitriding, carburizing, enameling, hardening, normalizing, etc., cross-referenced to furnace or atmosphere generator recommended for specific process listed under those major categories. Hayes Furnace Selection Chart, C. I. Hayes, Inc., 824 Wellington Ave., Cranston 10, R.I. **L-3-10**

Resin Dispensing

Triplematic pump for automatic mixing, metering and dispensing two-part resins described in 4-page illustrated folder; discusses design, operation and means of automating; also presents line of epoxy and phenolic adhesives and setting compounds, and mentions company's training school for Triplematic pump operators. H. V. Hardman Co., Inc., 571 Cortlandt St., Belleville 9, N.J. **L-3-11**

Pillow Block Bearings

Well-illustrated 12-page Bulletin No. 106 offers complete information on pillow block and flange bearings, pointing out details of construction and advantages; includes dimensions and specifications. Adv. Dept., Hoover Ball and Bearing Co., 5400 S. State Rd., Ann Arbor, Mich. **L-3-12**

Boring

Series of microadjustment MicroDex boring units for use with throwaway inserts presented in 16-page catalog emphasizing important features and advantages; discusses applications, and cost and time considerations; includes specifications and prices. Valenite Metals, Box 205, Royal Oak, Mich. **L-3-13**

Fasteners

Condensed 8-page bulleting, Form 2449, describes line of industrial fasteners including socket screw products, pressure plugs, locknuts, spring pins, dowel pins and steel collars; gives basic data on types, sizes, threads and plating as well as design features and application information; includes photos and cutaway drawings. Standard Pressed Steel Co., Jenkintown, Pa. **L-3-14**

Milling and Boring

How to improve milling and boring operations with economy is discussed in 12-page Booklet 68, "Winning Combinations That Reduce Cost of Chips". Deals with importance of matching cutters to exact capabilities of machines and to the work; how to get maximum performance from replacement blades; setup and cutter sharpening equipment; and description of typical milling and boring cutters, tool designs and factors affecting selection. Cutter Div., The Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill. **L-3-15**

Welding Positioner Data

Importance of ground current conduction pertaining to welding positioners explained in detail in 13-page article; illustrated to clarify text. Aronson Machine Co., Arcade, N.Y. **L-3-16**

Silicones

Up-to-date 16-page reference guide to company's silicone products; describes what silicones best meet needs of variety of problems; where such products currently are being used; and how to get specific data on silicone material best suited to different applications. Dow Corning Corp., Midland, Mich. **L-3-17**

Thread Rolling

Complete information on two-die type horizontal cylindrical die thread rolling machine presented in Bulletin B111-1; well illustrated with close-up views of important design features that show versatility of application. Reed Rolled Thread Die Co., 791 Main St., Holden, Mass. **L-3-18**

Corrosion Resistant Alloys

Charts and graphs that show penetration rates for Haynes alloys in more than 250 corrosives included in 40-page reference booklet which serves as guide to these alloys. Haynes Stellite Co., Div. of Union Carbide Corp., Kokomo, Ind. **L-3-19**

Welding

All phases of resistance welding, spot welding, projection welding, seam welding, flash welding are described and illustrated in 28-page bulletin "Federal PP-54"; provides working knowledge of basic principles of resistance welding through resistance welding formula, data on how to calculate welding pressures, projection specifications, seam welding charts, flash welding information plus other pertinent data. The Federal Machine and Welder Co., Warren, Ohio. **L-3-20**

Casting

The Minicast process which combines qualities of investment casting with other methods as coining, cold-forming, screw machine production, etc., described and illustrated in brochure offering information on design, production and applications; includes case examples of parts produced by the process. Casting Engineers, Inc., 2323 N. Bosworth Ave., Chicago 14, Ill. **L-3-21**

Carbide Cutting Tools

Two illustrated catalogs show company's broad selection of carbide cutting tools, blanks and inserts. Reamers, drills, end mills, milling cutters, counterbores, single point tools, blanks and inserts, plus illustrated section dealing with pertinent data on grinding and operating, selection for specific jobs, etc. presented in Catalog No. 59. Complete line of mechanical negative and positive style tool holders, with inserts, chipbreakers and replacement parts, presented in Catalog No. 59-A. Wendt-Sonis Co., 10th and Collier Sts., Hannibal, Mo. **L-3-22**

Gears

Precision gears from less than one in. to more than 200 in. in diameter and with tooth-to-tooth spacing accuracies of 0.0002 in. described in extensively illustrated 24-page Bulletin GEA-6430; gives detailed explanation of design, precision manufacturing methods involved and laboratory controls; also describes allied products such as various gear testing devices, high speed flexible couplings manufactured by the company. General Electric Co., 1 River Rd., Schenectady 5, N. Y. **L-3-23**

Drill Stands

Use and applications of magnetic drill stands discussed in 4-page bulletin, Thor No. 10406, prepared by company's chief electric tool designer, Peter G. Rebechini; describes precision drilling possibilities in difficult or remote areas and also explains how to avoid dismantling heavy machinery or building rigging for drilling work through use of magnetic stands. Thor Power Tool Co., 175 N. State St., Aurora, Ill. **L-3-24**

Zinc Castings

Revised 62-page edition of "The End Uses of Zinc Die Castings" contains 192 new photos, two new sections and 14 additional pages to show and describe new applications of zinc die castings to emphasize practical advantages of Zamak alloys. The New Jersey Zinc Co., 160 Front St., New York 38, N.Y. **L-3-25**

technical shorts

THE ENTIRE investment procedure for precision castings can be completed in a single operation while under vacuum with equipment introduced by Centrifugal Casting Supply Co. According to the company's engineers, a prime feature of the procedure is a freedom of gating. Blind holes and recesses allow a number of patterns to be stacked in each flask. A flip of a switch starts the entire procedure of mixing the investment—all of which is viewed through the window by the operator. When the investment is ready for pouring, the operator uses outside levers to control tilting the bowl to pouring position and easily rotates the turntable, stopping at the precise filling position for each flask. Because the investment is mixed and poured under vacuum, accurately reproduced patterns result in smooth castings.

Vacuum Technique For Investments Shows Advantages

* * *

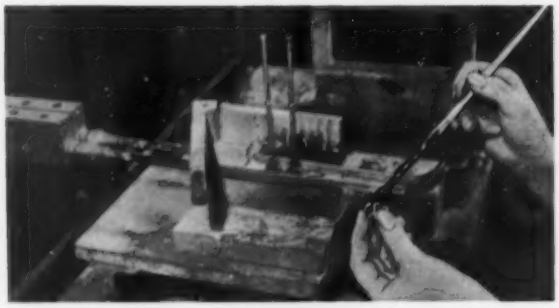
A TECHNIQUE for producing metal powders with particles a thousand times smaller than those previously obtainable may show the way to processes or applications in the catalytic chemical process, powder metallurgy and other industries. According to Frederick H. Greene, Jr., vice-president of National Research Corp. who revealed the development, "the powders are in effect completely new materials with remarkably different properties from the base metals of which they are made." Particles, which are only one-millionth of an inch in diameter, are very much smaller than wavelengths of visible light. Because of the minute size, the powerful forces existing between individual molecules may now be used to great advantage.

Produce Super Fine Powder Metal For New Qualities

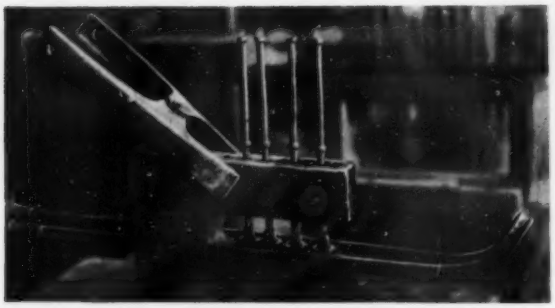
According to Philip J. Clough, metallurgical project director, "major chemical significance of the powders lies in their potential ability to enter into or catalyze reactions which the same metals in a coarser state will not do at all or will do only with application of large amounts of externally supplied energy in the form of high temperature or pressure or both. In powder metallurgy, the super fine powders may open up short cuts to new, exact-composition alloys with superior physical properties.

Several significant features and properties of ultra fine metals powders have been established. For example, aluminum metal powder shows unusual behavior which is attributed to substantially increased surface energy and surface area. NRC specifications guarantee less than 0.1 micron, although electron photomicrographs at a magnification of 50,000 diameters show the particles actually as 0.005 to 0.06 microns with an average diameter of 0.03 microns. Surface energy is known to increase rapidly when particle diameters fall below 0.1 micron. Surface area of the new high-energy form of aluminum is about 750,000 sq centimeters per gram. In some catalytic chemical processes, lower reaction thresholds, higher reaction rates and increased yield appear to be attainable.

First of the metals to receive consideration for production scale-up has been aluminum. Iron and nickel powders are expected to offer magnetic and electromagnetic applications.



Operator applying Special Handy Flux Type B-1 to components of de-icer tube before brazing.



Here, four de-icer assemblies in jig are being brazed by induction heat.

First step in brazing manifold. Operator applies Special Handy Flux Type B-1 to joint area prior to hand brazing. B-1 Flux is particularly effective in removing refractory oxides such as those formed in stainless steels and carbides.

Operator preheats joint area before hand feeding Handy & Harman silver alloy Braze 541.

Here's how you can get uncompromising **JOINT STRENGTH** at **LOW-COST**... Handy & Harman **SILVER BRAZING**

Here, two different parts are being brazed. Operator in foreground hand feeds alloy on aircraft manifold joint while operator in background brazes nipple on hydraulic oil filter. Gas-air hand torches are used in both cases.

The first requisite for virtually any aircraft part is unimpaired strength. Jerden Manufacturing Company, Indianapolis, makes a number of tubular aircraft parts and components and each of them must pass rigid tests before acceptance. Three of the components are a hydraulic aircraft filter, a manifold assembly and a de-icing tube. Tubes and fittings are 410 and 321 stainless steel, brazed with Handy & Harman silver alloy Braze 541 (formerly 4772).

Handy & Harman's Braze 541 is specifically formulated for brazing stainless steels. It has a high flow point (1575°F), and its excellent strength at elevated operating temperatures especially recommends it for many aircraft component applications. Braze 541 is a "tailor-made" brazing alloy, designed to do a specific joining job and do it particularly well. It is an example of Handy & Harman's ability to supply a specific alloy to fit a specific need, a service that remains constantly available to you.

You may find that your metal joining requirements are more or less special or you may not be fully aware of what you require. In any case, we invite you to consult us about what you are joining and *would like to join better*. We may be able to help you from many points of view: economy, joint strength, conductivity, ease of production and many others.

GET THE FACTS

Technical Bulletins T-1 and T-2 give the general characteristics of silver brazing alloys plus the compositions, melt and flow points of 36 separate alloys. Write for your copies.

Your NO. 1 Source of Supply and Authority on Brazing Alloys

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Men at Work

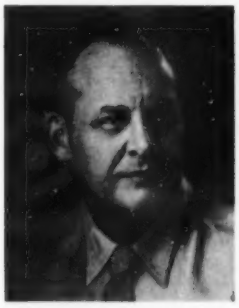
ALFRED SHERMAN, manufacturing vice-president of Monarch Machine Tool Co. has assumed the post of consulting vice-president until his retirement in June. He has been with the company for 43 years. Elected to succeed him is former assistant manufacturing vice-president FRANK GRAZIANO.

FRANK U. HAYES became president and general manager of Sperry Products, Inc. in January. To take this post, he resigned as vice-president and assistant general manager of The Bullard Co.

HENRY F. DEVER was elected president of the Metal Manufacturers' Assn. of Philadelphia. Mr. Dever is vice-president of Minneapolis-Honeywell Regulator Co. and president of its Brown Instruments division.

At the annual meeting of the Material Handling Institute, Inc., EUGENE CALDWELL, general manager of Baker Industrial Trucks, a division of Otis Elevator Co. was elected to serve as president for the 1959 term. Serving with him will be C. L. FELL, vice-president-marketing of American MonoRail Co., as first vice-president; and ROBERT F. MOODY, sales manager of Hyster Co.'s Domestic Industrial Truck Div., as second vice-president.

Two promotions recently announced by Atkins Saw Div. of Borg-Warner Corp. involved CHARLES L. CATT and CARL E. INGELS. Mr. Ingels, who has been with Atkins for the past 22 years, became manager of manufacturing of the division. Mr. Catt joined Atkins from Rheem Automotive Co. to become manager of production and material control.



Robert R. Miller, president of Precision Metalsmiths, Inc. was elected president of the Investment Casting Institute during the recent annual meeting in New York.

Paul W. Norris is new president of Denison Engineering Div. of American Brake Shoe Co. He previously served as vice-president and general manager of the division.

Ralph M. Trent, a veteran of 28 years with Pangborn Corp., has been elected president of the Corporation. Since 1957 he has been its executive vice-president.

Appointment of ANKER GERALD CHRISTENSEN as director of manufacturing of the Read Standard Div. was revealed by Capitol Products Corp. Prior to this appointment, he was executive vice-president of Hightower Morse and Co. and president of Spencer Clutch Co.

J. VANCE FOSTER was promoted to applications engineering manager of Potter & Brumfield, Inc. He has been applications laboratory supervisor.

Ingersoll Products Div. of Borg-Warner Corp. recently appointed M. R. McLary to serve as vice-president and manager.

EUGENE J. HOCHDANNER became chief engineer at Latrobe Steel Co. in charge of engineering design, installation and maintenance of buildings, equipment and facilities. He joined Latrobe after serving as works engineer at Allegheny-Ludlum's Brackenridge Works.

Executive responsibilities at Parker Seal Co. Div of Parker-Hannifin Corp. were increased for PAUL F. SMITH, SCOTT A. ROGERS and T. J. MCCUISTION. Mr. Smith, general manager of Parker Seal, became president of the division; Mr. Rogers, assistant general manager, became vice-president; and Mr. McCuistion, sales manager, was made vice-president-sales.

Changes in the top corporate staff at Associated Spring Corp. made E. L. GOFF senior vice-president, and W. E. FROEHLICH vice-president of engineering. Mr. Goff has been executive vice-president of the company while Mr. Froehlich has been vice-president of marketing.

CHARLES C. JARCHOW, president of American Steel Foundries since 1949, was elected chairman of the board; and JOSEPH B. LANTERMAN was named to succeed him as president and chief executive officer. Mr. Lanterman has been vice-president since 1954.

At American Chain & Cable Co., Inc., WILMOT F. WHEELER, JR., formerly vice-president, was elected executive vice-president and a director of the corporation.

Directors at Norton Co. elected DONALD L. PRICE a vice-president of the company. A veteran of 38 years with the company's sales efforts, he has been sales manager of grinding wheels for the Abrasive Div. since 1955. He is succeeded by Robert Cushman, manager of marketing services.

The Austin Co. announced that A. T. WAIDELICH, a vice-president of the company, also has been elected director of engineering and research to succeed J. K. GANNETT who retired.

At the same time, announcement was made of the election of HAMILTON BEATTY as a vice-president while he continues as manager of sales development.

MITCHELL P. KARTALIA was elected a vice-president of Square D Co.'s marketing division. Associated with the company since 1940, he has been manager of the division.

Elections at Detroit Stamping Co. made WILLIAM H. ROBERTS executive vice-president of the company and HARRY C. ROBESON vice-president of sales. Mr. Roberts previously was vice-president in charge of the finished products division, while Mr. Robeson has been stampings sales manager.

At the same time company appointments involved Herbert McMillan, who became sales manager of the stamping division, and Charles Hoppe, who was named sales manager of the finished products division.

Former director of development at Ren Plastics, J. WALTER GUYER has been elected vice-president and director of research of Conap, Inc.

GEORGE R. METZDORF was named to the new post of manufacturing vice-president at Capitol Products Corp. He previously was director of manufacturing of the York Div. of Borg-Warner Corp. He will be responsible for all manufacturing and manufacturing services throughout the country.

GEORGE S. CHIARAMONTE has been named sales manager of the Cogsdill Twist Drill and Threadwell Tap & Die Divs. of Sheffield Corp. Mr. Chiaramonte, who belongs to ASTE's Hartford chapter, was sales manager of The E. Horton & Sons Co. which later became Horton Div. of United-Greenfield Corp.

Appointment of PAUL E. CATE as director of industrial and production engineering for the Fulton Sylphon Div. was announced by Robertshaw-Fulton Controls Co. He will be in charge of industrial and production engineering, cost estimating and toolroom operation.

CHARLES FOOTE is now manager of the Product Engineering Section of The Weatherhead Co.'s Fort Wayne Div. He has been associated with the company since 1945.

ROBERT F. SCHUTZ is new executive vice-president and manager of Ingersoll-Kalamazoo Div. of Borg-Warner Corp. At the same time, the division named BEN A. SWENNES vice-president and director of engineering, and Anthony S. Mrozek vice-president in charge of defense sales.

Election of ROBERT E. LEWIS to the office of presidency was made public by Sylvania Electric Products Inc. Prior to this he was a senior vice-president of the company. He succeeds Don G. Mitchell who continues as chairman of the board.

good READING

TECHNICAL REPORT WRITING—*By James W. Souther. Published by John Wiley & Sons, 440 Fourth Ave., New York 16, N. Y. Price: $2.95. 80 pages.*

It is important for the engineer to communciate his ideas in a logical, legible form to others for use. In this book, the author has approached the technical writing field as an engineer would approach design of a new product. Analysis, investigation, design and application are the fundamental steps.

The approach is one of taking component pieces of a report and building it into a final rather than the conventional use of a finished report for analysis. In the chapter on analysis, the purpose of the report, the industrial role of the report and the audience to be informed are covered. Under the investigation chapter, the discussion includes the plans of the attack, how to gather material and evaluation of the researched material. Determining the content of the final report, the illustrative material and the final form are part of the chapter on design. Throughout the book, the author has used illustrations of good and bad techniques and actual examples of reports from industry.

MODEL MAKING FOR INDUSTRIAL DESIGN—*By Ralph R. Knoblaugh. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $9.75. 300 pages.*

The techniques used by model makers to express industrial design ideas in three dimension are covered in this book. They include the working of plaster, plastics, metal and wood with simple hand tools and small power tools. Pictures of actual industrial models and step-by-step manufacture of some items are included.

Planning and layout of a model project, finishing, presentations and color theories for the model maker as well as a discussion of corrections on

existing models are described in detail. Power tools and general equipment needed for model making and the actual requirements for the model shop are described in special sections.

ROLLING OF METALS, A REPORT OF THE ASME RESEARCH COMMITTEE ON PLASTIC FLOW OF METALS—*Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price $5.00. 104 pages.*

This report deals with the results of an investigation on the contact stress distribution in cold rolling of thick bars of aluminum, copper and low carbon steel. Attempts to measure the contact normal in shear stresses simultaneously were made but only the normal stresses were successfully recorded. Experimental difficulties, the resultant technique and the apparatus used to conduct the tests are fully described. Pressure distributions, material properties and supplementary data for mathematical analysis are offered in hopes that additional basic research in this field will be encouraged.

AUTOMATION SYSTEMS—PROCEEDINGS OF THE EIA CONFERENCE—*Sponsored by the Electronics Industries Association, Engineering Dept. Published by Engineering Publishers, Div. of the A. C. Book Co., Inc., New York. Price $5.00, 190 pages.*

Automation has developed from a theoretical idea into practical application in a few short years. During this period, much experience has been accumulated on its effect on industry and business. In this book, engineers as well as leaders in the field of economics, education, labor and social work take a critical look at automation as it exists today and attempt to evaluate it. Engineers and executives having an active interest in automation will find this book interesting reading.

MODERN PEARLITIC MALLEABLE CASTINGS HANDBOOK—*Published by the Malleable Research and Development Foundation, Grandville, Ohio. Available to anyone responsible for material specification or selection by writing on company letterhead. 76 pages.*

This handbook furnishes an introduction to pearlitic malleable as well as a reference to the latest engineering data on this material. Four chapters cover the introduction to the material, castings, design fundamentals and actual data for application. Three charts contain information to convert basic design needs into final pearlitic malleable specifications. An additional feature is a glossary of metallurgical terms plus a useful bibliography.

TOOL ENGINEERING in Europe

By M. Kronenberg
Consulting Engineer
Cincinnati 6, Ohio

Doctoral Theses

The first chair for tool engineering and scientific management was established in 1904 at Berlin Technical University under the guidance of Prof. George Schlesinger. Incorporated into the engineering education at university level, the profession of tool engineering was officially recognized, with courses leading—if desired—to a doctor's degree in engineering, as in the case of other engineering fields.

The laboratory for tool engineering research associated with this chair became the proving ground for many developments spreading later to other technical universities.

Tool engineering doctoral theses are often of interest to industry. Some recently finished theses are:

H. Bischoff: "Investigations of the Effect of High Hydraulic Pressures on Brinell Hardness of Metals and Nonmetals" ("Untersuchungen über den Einfluss von hohen hydraulischen Drücken auf die Brinellharte von Metallen und Nichtmetallen"). Technical University of Brunswick (Braunschweig).

H. Helmerding: "Investigations of the Effect of Cutting Fluid Temperature on the Machining of Metals" ("Untersuchungen über den Einfluss der Kuhlmittel Temperatur auf die Zerspanung von Metallen"). Technical University of Brunswick.

M. P. Eriksen: "Testing of Machinability Properties of Various Work and Tool Materials in Finishing Cuts by the Method of Chip Compression and Chip Weight" ("Prüfung der Zerspanungs Eigenschaften verschiedener Werkstoffe und Werkzeuge im Feinschnitt durch Spanstauchungs Messung und Spange wichtsbestion mung"). Technical University of Stuttgart.

W. Eychmüller: "Investigation of Deformation of Nonferrous Metals in the Drawing of Tubes" ("Untersuchungen über Formanderungen von Nichteisen Metallen beim Rohrziehen"). Technical

University of Stuttgart.

K. Schulz: "Contributions to the Problem of Measuring Cutting Forces When Planing Wood under Rotating Cutting Motion Including Wear Tests on Wood Cutting Tools" ("Beitrag Zur Schnittkraft Messung beim Hobeln von Holz mit Hobelmesser"). Technical University of Brunswick.

K. E. Lang: "Cutting Force Measurements in Cylindrical Grinding Operations Using Various Cooling Methods" ("Schnittkraft Messungen beim Rundschleifer unter Berück-sichtigung verschiedener Kühlverfahren"). Technical University of Brunswick.

W. Mühlhäuser: "Investigation of the Hydroform Method" ("Untersuchung über das Hydroform Verfahren"). Technical University of Stuttgart.

H. Koelzer: "Testing of Deep-Drawing Properties of Sheet Metals Used in Bodies of Automobiles" ("Die technische Prufung von Tiefziehblechen für den Karosserieban"). Technical University of Brunswick.

E. Schmalenbach: "Bonding of Sintered Material and Solid Metals" ("Uber den Verbund Zwischen Sinter Werkstoffen und Kompakten Metallen"). Technical University of Brunswick.

K. Ruckhausen: "Elimination of Dust Particles from Technically Smooth Surfaces by Pounding or Vibration" ("Beseitigung von Staub Ansatzen auf technisch Glatten Oberflachen durch Klopfen oder Vibrieren"). Technical University of Stuttgart. Theses submitted to other universities will be discussed in a later report.

Drilling with Carbides

The development of twist drills having carbide cutting edges is associated with the development of special drill point shapes, as indicated by H. Haidt in an article published in *Industrieblatt*, Vol. 58 (10), 1958, pages 419-424, under the title: "Das Bohren mit Hartmetallwerkzeugen." A special tool grinder for grinding the bits so as to ensure the desired or recommended shape angle at the point and clearance surface is also discussed.

Hydraulic Controls

Two basic systems exist for hydraulically controlled machine tools according to a publication by W. Reuthe that appeared in the December, 1958, issue of *Werkstatt Technik und Maschinenbau*, pages 631 to 635. "Neuzeitliche Hydraulische Antriebs Systeme fuer Werkzeug Maschinen" is the title of the article.

The author differentiates between hydrostatic and hydrodynamic systems, depending on whether static or kinetic energy is transmitted. Examples of hydrostatic systems are hydraulic presses and the table drive in planers or milling machines not exceeding a velocity of about 100 fpm under load.

In these cases work is done due to the oil pressure, not to its velocity.

Four hydrostatic designs are discussed in detail. One design is exemplified by throttle valve drives for grinding machines and the regulating pumps in such machines. The hydraulic feed control for the head drives of drilling machines and the hydraulic control of presses are explained, using circuit diagrams. A special section in the article deals with the problem of accurate oil supply in cases where uniform feeds are required and where the increments for changing feeds must be as small as possible.

Machining Spline Shafts

An investigation of the mathematical and technical relationships involved in the hobbing of spline shafts has been carried out by E. Burbeck in cooperation with the German Production Institute (REFA) which is associated with the Association of German Engineers (VDI). The report was published under the title: "Betrachtungen zum Walzfrasen von Keilwellen" in *Werkstatt und Betrieb*, No. 11, 1958, pages 661-667.

The article deals with the shifting of peripheral milling cutters (hobs) for machining of spline shafts at close tolerances and also covers the steps to be taken into consideration by the machine shop operator in order to produce spline shafts of high accuracy. It is indicated that the center distance from tool to work must be held very closely. The author also discusses the effect of correcting the profile of the cutter teeth and presents numerous formulas and nomographs for determining the number of cuts to be taken, tool geometry, and other items affecting the accuracy of hobbed spline shafts.

An engineering conference and exhibit, sponsored by Bendix Aviation Corp., was held in February in Frankfurt and Paris for customers, foreign affiliates, distributors and representatives in Western Europe. The company's aim was to take its top technical people and a comprehensive exhibit of its products of advanced engineering so that Europeans might see the equipment and discuss it with the men who developed and produced it.

Papers presented at the seminar included those on selective calling and data link systems. Supplementary sessions with specialized groups answered specific technical questions.

Company scientists and technicians demonstrated America's know-how in aviation, missiles and electronics and explained operations of a variety of Bendix products.

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Tech Digests

Trepanning

Development and Application

By Arthur C. Heidenreich
Manager
Tool Design Dept.
Warner and Swasey Co.
Cleveland, Ohio

TREPANNING is a method of producing a hole by cutting out a narrow ring of material in the workpiece, leaving a center core instead of removing all the material in chips such as in spade drilling. Trepanning is generally associated with the large steel and forging companies required by industry to furnish forgings with holes of considerable size and length. This is no longer true because of the introduction of the machines, *Fig.* 1, adapted for the purpose of utilizing the trepan method. In the machine tool industry this method has been used for smaller and shorter holes realizing the same advantages.

Trepanning not only offers a faster means of producing a hole, but the resultant hole is more accurate, more concentric and has a better finish. The savings in time is tremendous because of the higher cutting speeds and feeds that can be used with carbide tools compared to those that can be used with high-speed steel tools. A major part of the saving is still the fact that we are moving less material. For example, it would take 143 minutes to spade drill a 4¾ inch diameter hole in a 4 foot long part plus an additional 24 minutes to ream, or a total of 167 minutes; while to produce the same hole by the trepanning method would take 21 minutes complete, a savings of 146 minutes.

For actual comparison of times to produce holes between the ranges of 2 to 6¼ inches, see the chart in *Fig.* 3. Because the trepan head is a self-centering type of tool, another big advantage is that concentricity of 0.005 to 0.010 inch and straightness can be

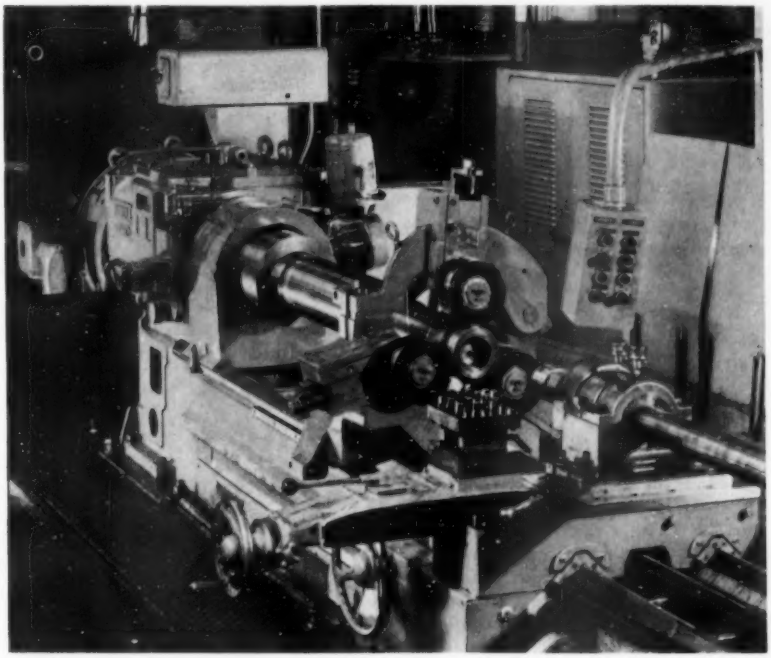


Fig. 1. Trepan lathe with the workpiece completely bored out and ready to be unloaded. A support bushing saddle is mounted on the ways to support the trepan bar. Bushings are changed for various bars.

Fig. 2. Chip conveyor and feed motor used on a trepan lathe. The coolant line enters the end of the trepan bar.

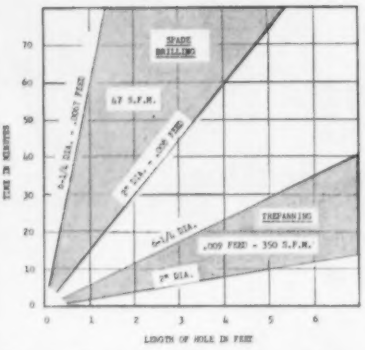


Fig. 3. Time comparison chart of trepanning versus spade drilling to produce holes of comparable sizes.

obtained. Long life of carbide also insures minimum wear which enables the maintenance of a tolerance of ± 0.003 inch on the hole diameter. The finish in the hole is also improved owing to the burnishing action of the two wear pads on the trepan head.

Types of Trepanning: One is where the trepan bar is piloted in a bushing located in a gland with a revolving seal resting against the end of the workpiece. The coolant comes into the gland over the outside of the trepan head and rushes out through the center of the bar carrying off the chips. The second type is where the bar is piloted only by a bushing near the end of the workpiece and the coolant comes in through the center of the bar and pushes the chips over the outside of the trepan head and out of the workpiece. Both types were tried and the second found to be more successful and less troublesome. Therefore we standardized on that method.

Machine Requirements: In 1952, there were not many machines on the market for this type of boring so we designed our own machine, using a special 4-A saddle type machine bed with 15 foot long ways, *Fig.* 1. This machine was developed to bore holes in the range of 2 to 9¼-inch diameter. The spindle has an 11-inch American standard spindle nose driven by a direct coupled 100-hp d-c variable speed motor, 500 to 1500 rpm that gives infinitely variable speeds of 120 to 360 rpm in low and 267 to 800 rpm in high. The bed is mounted on a concrete foundation which incorporates a coolant pan and a coolant sump of 900-gallon capacity. A power chip conveyor, *Fig.* 2, is mounted on the rear of the machine ways to carry the chips out of the machine and into a chip container located at the end of the machine. The coolant pump is a geared type pump which delivers 80 gpm at 250 psi. It is driven by a 20-hp, 1200-rpm motor, directly coupled to the pump. The coolant is filtered by a magnetic type oil filter that with a 2½ inch diameter pipe, delivers up to 200 gpm. The parts are held by a self-centering three jaw chuck and supported by a three roll steady rest.

Trepan Head: The trepan head is cylindrical and made from AISI A-4150 steel, R_C 36 to 40. It is designed to be a self-centering type tool. This is accomplished by using only one cutter which is a replaceable shank type cutter, tipped with carbide. To support and guide the cutter there are two rest pads on the head, one being 90 deg and the other being 180 deg from the cutter position. The trepan head fits onto the trepan bar by means of a pilot diameter and is driven by three lugs. It is locked to the trepan bar by three socket head capscrews. Behind the cutting edge of the cutter there is a relief portion on the outside diameter of the head to enable free flushing of the chips. As long as there is plenty of coolant volume this relief should be made as large as possible. The amount of clearance between the inside diameter of the head and the outside diameter of the core should be controlled so that it creates a restriction for the volume of coolant trying to pass through. This creates a high velocity centrifuge type action forcing the chips through a small aperture to the outside of the tube. To calculate this, we use a formula shown in *Fig.* 4. It would not be necessary to calculate this

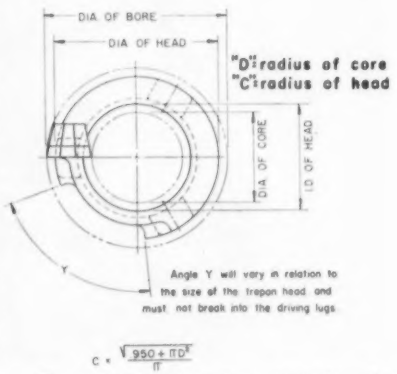
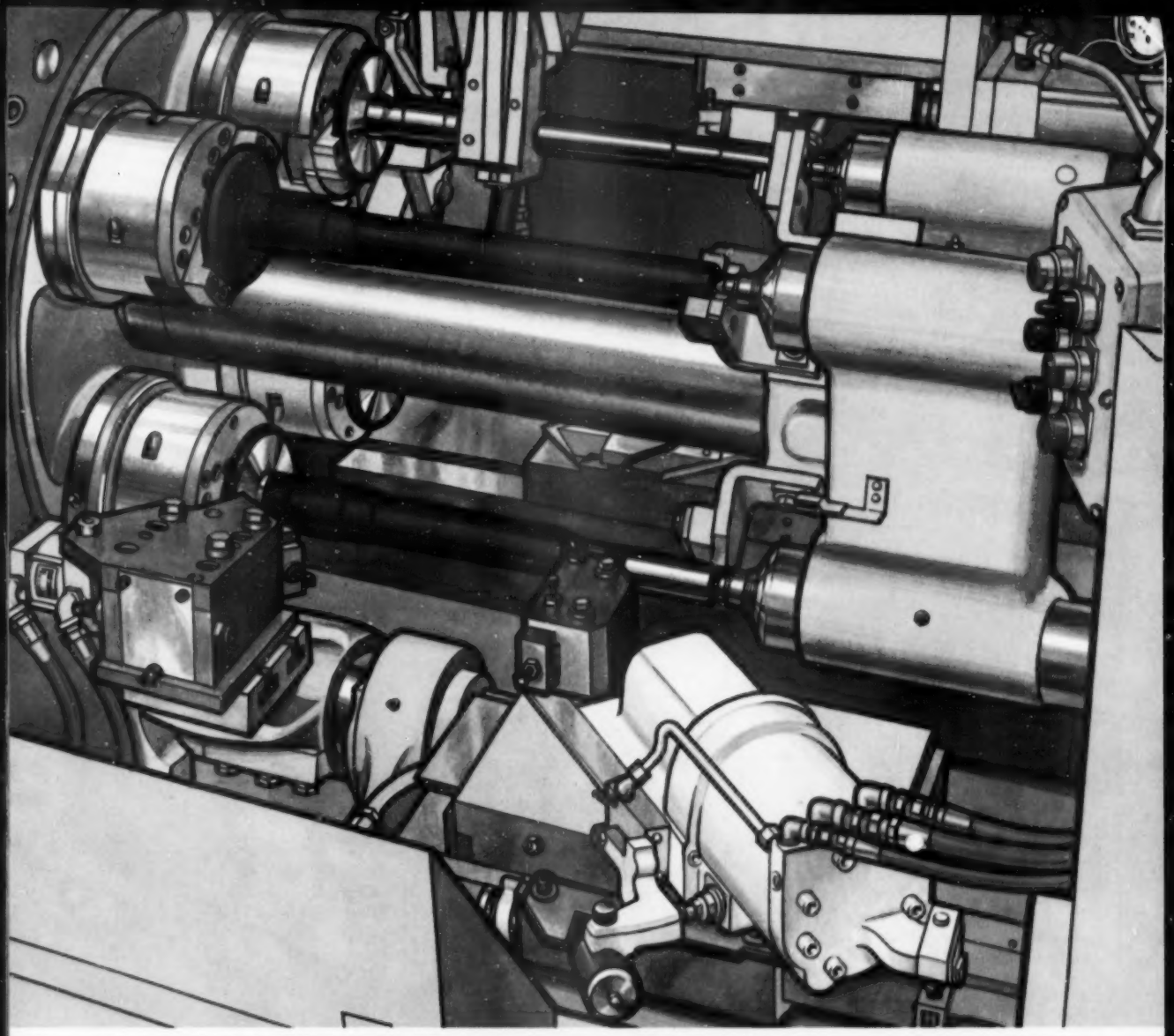


Fig. 4. Design data for calculating the inside diameter of a trepan head to determine the coolant pressure.



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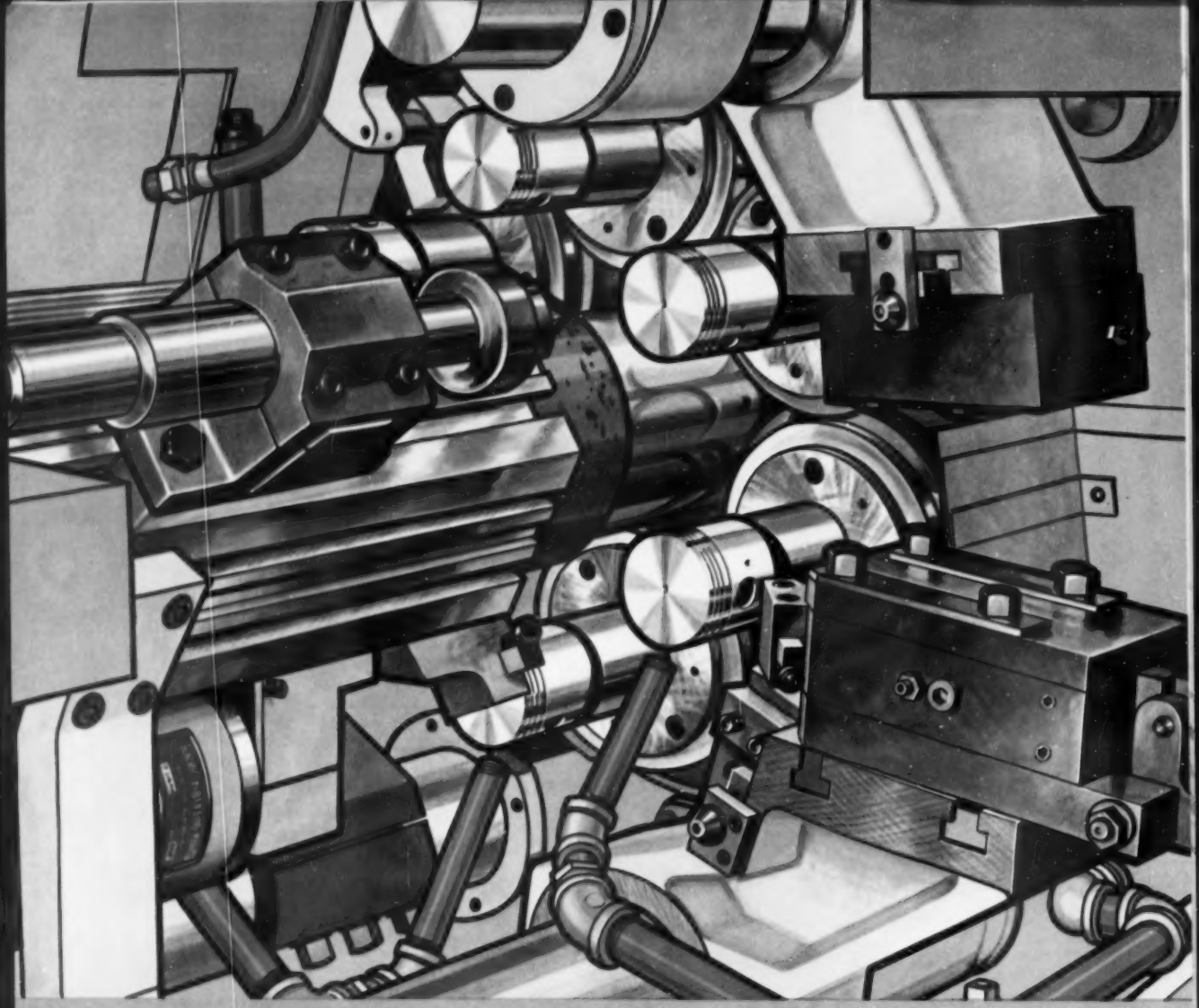

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diameter if one wished to use an extra capacity pump and have an excess of coolant. The rest pad is a steel body with a piece of carbide brazed in place.

To date, most of our time has been spent in developing trepanning to be successful for production use. In designing the trepan cutter and wear pads, we leaned toward what would be best for successful trepanning. Not knowing how many parts could be covered by this method of producing holes, we were forced to design the cutter and pads so that they could be made in our shop or any other shop without extensive tooling. Now that we know what is necessary for successful trepanning, most of our efforts are being spent on the reduction of tool cost. For example, we are thinking of going to a precision cast shank which would cost approximately $0.75, compared to our present cost of machining the shank from bar stock, of $3.75. We also can reduce the grinding cost of a standard carbide blank brazed to the cutter, by ordering preformed tips. At the present time, a standard tip, plus the brazing and grinding time, costs $7.50. The preformed tip, plus brazing and grinding time, would cost $4.00. In order to realize these savings, we must purchase special tooling for the precision castings and the preformed tip. The same type of savings made on rest pads.

Before spending this additional money on special tooling, we will wait for the results of tests on a new type of trepan head that we have developed which employs the throwaway carbide-tip theory.

In conclusion, I feel that trepanning means much to the design engineer because now parts can be designed with large holes of any length without causing the extremely high manufacturing cost of the part. Trepanning is an important step in machining progress.

Based on a paper presented at the Annual Meeting of The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

▼ ▼ ▼

Plastics for Tooling Aids

By William Ervin, Supervisor
Plastic Tooling Lab.
Delco-Remy Div.
General Motors Corp.
Anderson, Ind.

Plastic tooling has been gaining momentum rapidly in many industries for many types of jigs and fixtures. Many applications have been found for plastic

tooling as machine parts. Many machine parts that fail due to machine malfunction, such as temporary overloading, may be made satisfactorily from tool plastics. The materials are usually epoxy resins loaded with aluminum powder, silicates or carbide powders.

A transfer box for a commutator bar header is made with an aluminum-filled epoxy from an epoxy mold. The core pin for this hole is coated with a carbide-filled epoxy to give a wear-resistant surface on the face of the hole. This transfer box made from steel takes ten hours of a skilled toolmaker's time. In operation in the plant, we break three boxes a day.

The plastic box is made in one hour by semiskilled plastic workers. The usage on plastic boxes is four per day compared with three of the steel boxes. The savings are twenty-six hours each day of toolroom time. There is an additional savings because the punch is seldom broken when it hits the plastic.

A cam blank and hub are made from plastic for a labor cost of one hour for the two pieces. The cam is a blank because it is easily cut and only requires a single lobe. The cam hub has four tapped holes. The time to make these two parts from aluminum is eight hours compared with one hour to make them from plastic.

Another cam is made from epoxy tool plastics. The wear surface is coated with a wear-resistant surface; then the mold is poured with aluminum-filled material. The cost of the plastic cam is based on thirty-minutes labor compared with ten hours on the same cam made from steel.

A feeder bowl made from tool plastic has been surface coated with a quartz-filled material with aluminum-filled material behind the surface coat. One bowl allowed to feed small screws for ten days continuously shows little or no wear.

Based on a paper presented at the Regional Technical Conference of the Society of Plastics Engineers, Inc., 65 Prospect St., Stamford, Conn.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Material Utilization Program

By C. O. Johnson
Pontiac Motor Div.
General Motors Corp.

Commensurate with conservation of words, the abbreviation—"M. U." will be used when referring to the Material Utilization Program. Realizing that 51 percent of our sales dollar is consumed by material cost, our management decided to initiate an M. U. program. In the first year, 1956, our savings amounted to $8,524,000; in 1957, $9,236,000. In 1958, we dropped to $4,807,000. We attribute the 1958 reduction to lower volume and the natural loss of potential as M. U. progresses.

I would like to emphasize the importance of engineering's part in this program, not only in originating M. U. savings, but in processing the many requests made by other M. U. members. A high percentage of our dollar savings is realized through engineering cooperation. Another high dollar contributor is the purchasing department through savings in buying and materials processed through its salvage department.

The M. U. program requires constant

stimulation. One of the methods we use is the mailing of savings items from other companies to our committee requesting investigation in their areas to determine the possibility of realizing a similar savings at our plant. This particular investigation resulted in a savings of $1440. Approximately twenty of these requests are mailed to the committee each month.

Another of our stimulators is the "down-day-plan." Occasionally the manufacturing plants have no production scheduled on a workday. The superintendent issues a memo to each of his supervisors requesting at least one written M. U. suggestion be submitted during the day. A form is attached to the memo for the suggestions. One of our "down-day" projects resulted in a $100,000 savings in the engine plant. We also received several safety and quality improvement suggestions.

Where do you find M. U. savings? Literally, everywhere! Some are made effective immediately, some require many months of planning and research. One example is a recent saving of $151,000, made possible by the redesign of our axle shaft assembly. We worked on this one for two years.

Based on a paper presented at the Annual Meeting of the Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Radioactive Tracers in Rubber Research

By S. D. Gehman
Research Div.
Goodyear Tire and Rubber Co.

Because of the importance of sulfur in rubber chemistry, the beta ray emitting isotope sulfur-35 has been especially useful in extending the unique advantages of tracer methods and techniques to rubber research. Problems connected with the solubility of sulfur or sulfur containing compounds in rubber mixtures, migration and "blooming" or surface crystallizing tendencies can all be most readily investigated in the laboratory by means of radioactive sulfur. The use of tagged sulfur in an unvulcanized rubber mixture is the basis for a very convenient laboratory method for determining the amount of sulfur which combines chemically with the rubber during vulcanization. Tagged sulfur and sulfur compounds have been employed to provide new information for interpreting the complicated chemical reaction mechanisms involved in rubber vulcanization and to characterize the type of sulfur-rubber compounds which are formed. Extensive Russian publications in this field have emphasized the applicability of isotope exchange reactions for studying vulcanization.

Carbon-14 tagging has been used for diffusivity measurements to investigate the segmental motions and internal frictional forces for rubber molecules. But the use of carbon-14 in rubber research has been much more limited than that of sulfur-35 and the potentialities for securing new and useful information through tagging with carbon-14 have by no means been fully realized.

Based on a paper presented at the Annual Meeting of the Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

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Number 2 of a series.

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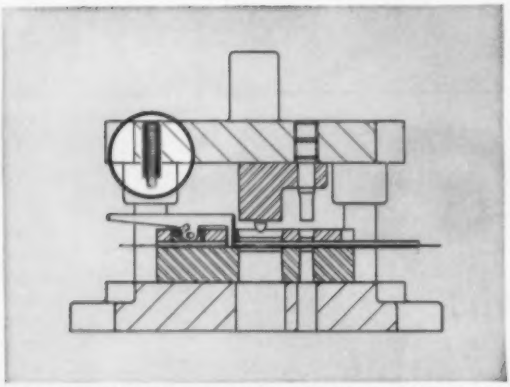

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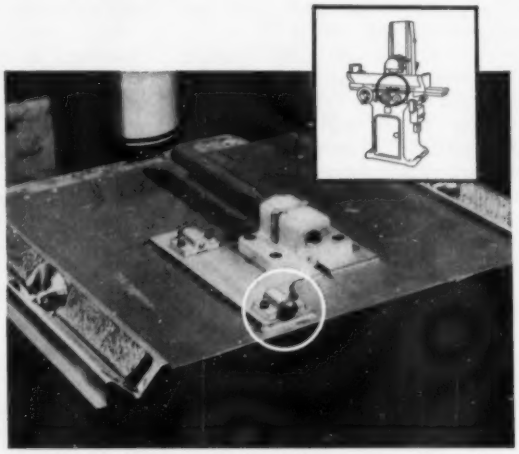
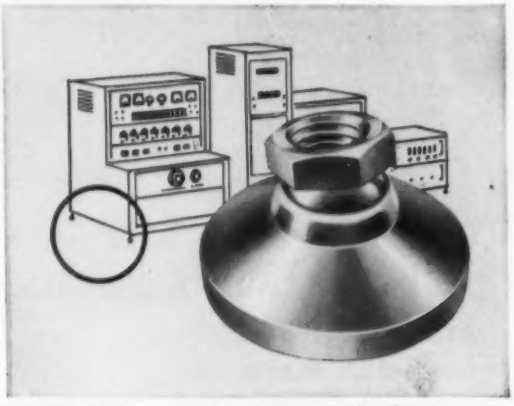


TO CUSHION SHOCK as the bed traverses, this surface grinder manufacturer uses two Vlier Spring Stops, reducing wear and tear on the machine. These clever, spring-loaded devices, ordinarily used on fixtures where the absence of side walls prevents the use of spring plungers, are now available in three standard sizes: 3 end pressures. Special sizes made to quantity orders.



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. . . And they give you "quality in details" . . . a feature you'll find only in the finest cutting tools. For example, the name, size, and type of every Card machine screw tap is *rolled* into the shank during manufacture. This deep, highly legible impression lasts throughout subsequent grindings . . . simplifies identification in the crib . . . permits easy reordering. Your Card technical man has the facts about all the "extras" that make Card machine screw taps the choice of shopmen everywhere. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

The CARD Quality

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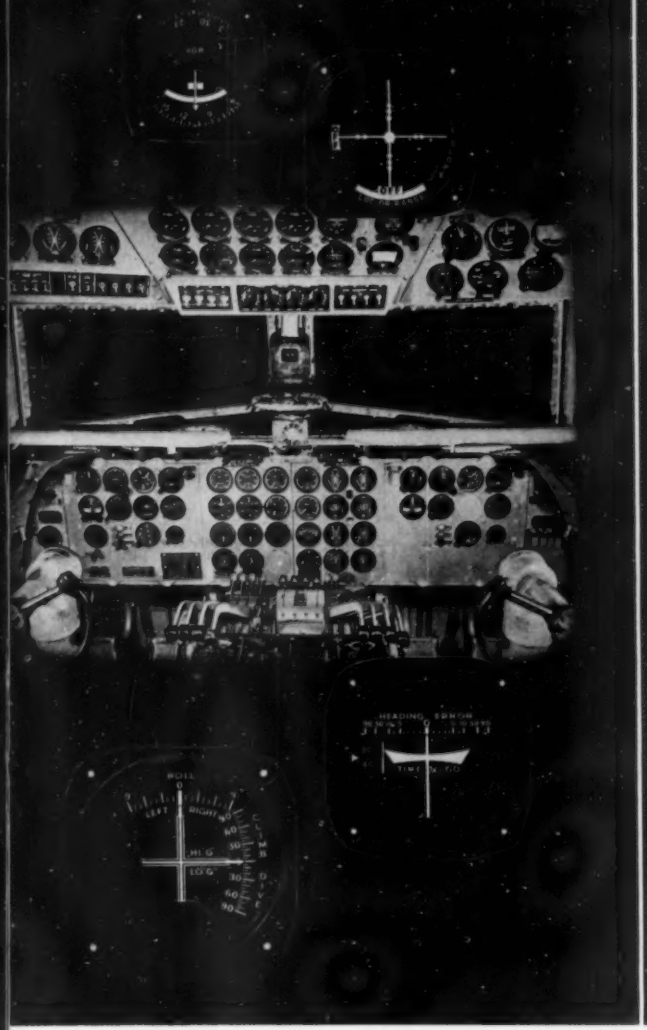
If you use carbide tools as much as airplanes use instruments . . .



Ordering Union carbide tools will cut your production time and costs

The more you use carbide tools the more you need Union

Union's continual development of new carbide tools for new purposes has resulted in a complete line of these modern tools — complete in variety, versatility and cutting abilities. Backing this broad line is nationwide service that will benefit you. A Union technical man will be glad to show you how to cut your production time and costs with Union carbide tools — or any other Union tools, including drills, end mills, reamers, hobs, inserted blade cutters and milling cutters. **Available nationally through Union Distributors** and stocked in Union warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City and San Francisco.

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TWIST DRILL COMPANY, Athol, Massachusetts

S. W. CARD DIVISION, Mansfield, Mass.; BUTTERFIELD DIVISION, Derby Line, Vt.

NEW!

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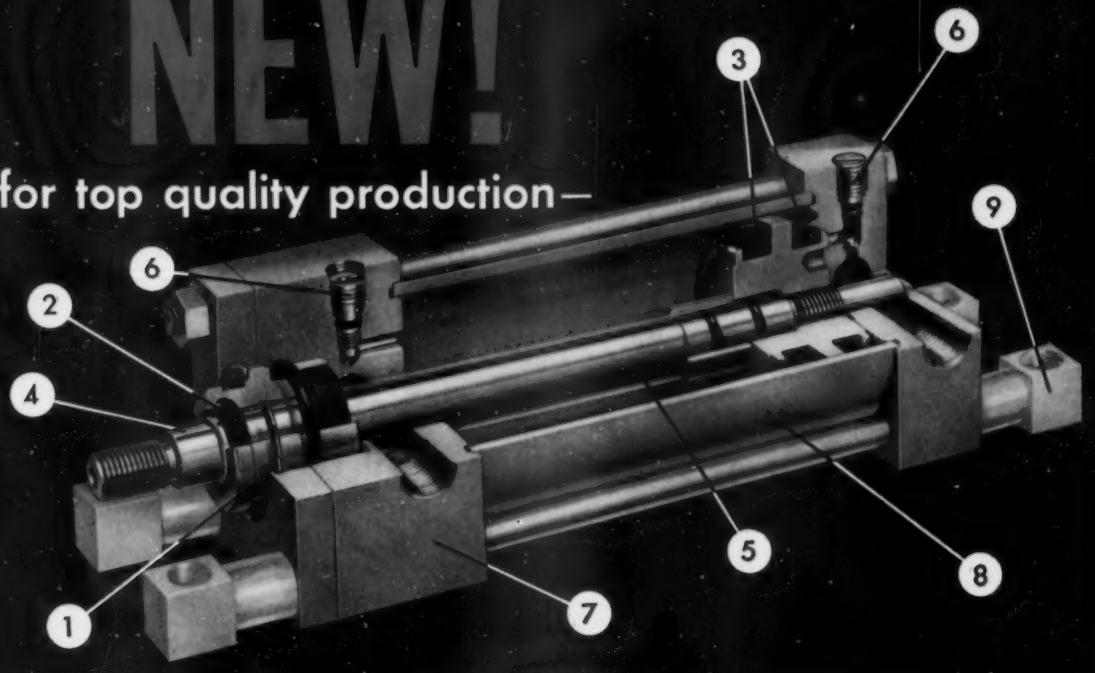


1. Bronze Bearing, with self-adjusting "U" Cup Piston Rod Seal for longer wear.
2. Rod Wiper protects Piston Rod Seal and keeps Cylinder clean.
3. "U" Cup Seals expand with pressure to provide positive seal with minimum friction.
4. Wrench Flats make for easy installation.
5. Ground, hard chrome-plated Piston Rods have minimum yield strength of 125,000 psi.
6. Self-locking cushion adjusting screw and ball check are below surface for protection . . . easily accessible.
7. For extra strength, Cylinder Ends and Mounting Plates are machined from bar stock and steel forgings.
8. Cylinder is precision-finished brass for extra heavy duty.
9. Variety of mountings can be interchanged—easily match any installation requirement.
10. Interchangeable with all JIC Cylinders.

SCHRADER SQUARE-END CYLINDERS

meet and exceed JIC specs . . . 250 psi air . . . 750 psi hydraulic!

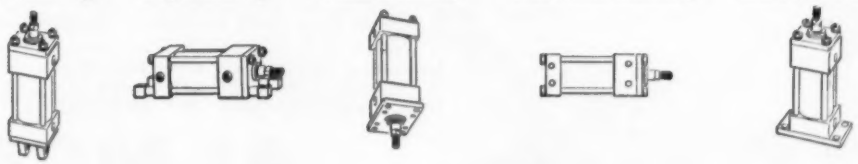
Here's compact, versatile straight-line power. Just look at the features!

Use Schrader's new square-end double-acting cylinders for holding, positioning, moving work—for push, pull or lifting—for automating manual operations. In five sizes up to 4-inch bore, and with five interchangeable mountings, these "square-ends" are economical and versatile. Bolt, leg, flush, side flush or base . . . each JIC Cylinder will mount all five ways. Suitable for air pressures to 250 psi, or hydraulically to 750 psi—available cushioned or non-cushioned.

You get safe, controlled, low-cost power with Schrader "square-ends"—another addition to the line of famous Schrader quality Air Control Products.

Complete stocks available locally—expert help to improve your air control hookups. Write for your complete specifications and data on these new "square-ends."

Bolt Mounting **Leg Mounting** **Flush Mounting** **Side-Flush Mounting** **Base Mounting**



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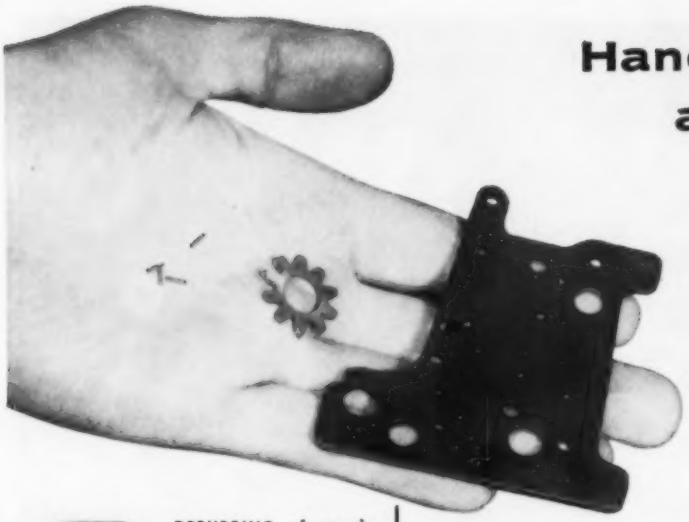
QUALITY AIR CONTROL PRODUCTS



Hand Your Deburring and Finishing Problems to ALMCO...

These companies did... and cut costs, improved quality, increased production.

DEBURRING of spark plug bushings by hand formerly caused many rejects at Canadian Pratt and Whitney. Costs were $104.20 per M with rejects totalling 12½%. Two Almco barrel finishing machines cut costs 97%, practically eliminated rejects.

SMALL GREASE GUN COUPLER JAWS (½" x ⅜") couldn't be deburred manually at a midwest screw products firm. With an Almco barrel finishing machine, 40,000 coupler jaws can now be deburred in 10 hours. Jaws are smooth, uniform, ready for plating.

DEBURRING AND POLISHING by manual methods proved expensive for delicate instrument and fountain pen parts at J. Bishop & Co. Almco barrel finishing machine increased output from 200 to 6000 parts per hour, cut costs 98.8%. Annual savings: $6,917.50.

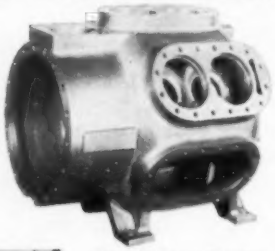
INCREASED PRODUCTION quotas demanded faster finishing at Alco Valve Co. Hand deburring and polishing finished only 200 stainless steel parts per hour. Almco machines are now barrel finishing over 1400 per hour, and to stricter finishing specs. Plant production needs are easily filled.

FILING burrs by hand formerly cost $55 per 100 needle plate forgings at Landis Machine Co. Now an Almco barrel finishing machine has cut finishing costs to 55 cents per 100 parts. Parts are uniform, rejects are eliminated. Savings come to 99%!

HEAVY WORK LOADS of roller bearings presented serious finishing problems at Timken's Columbus, Ohio plant. Now special heavy-duty Almco barrel finishing machines are processing two tons of rollers per load. And 50% of floor space has been saved, finishing costs have been slashed.

Large Parts too are Almco Barrel Finished!

AT AN IOWA FOUNDRY, an Almco barrel finishing machine deburrs, polishes 48 large wash machine agitators per hour. Fixtures hold castings firmly within Almco barrel. Rough edges are completely removed; castings are highly polished; appearance is improved.



AT AIR CONDITIONING FIRM, compressor housings weighing over 100 lbs. are Almco barrel finished. Almco process breaks sharp edges of castings, cleans internal surfaces, and improves surface finishes. Two housings are cleaned in 20 minute cycle! Workmen are relieved for other plant tasks!

Send Your Parts to Almco's Modern Test Laboratory.

Sample parts processed without obligation. Simply write on letterhead, sending parts direct to Albert Lea, enclosing specifications required. Complete, *free* report includes recommendation. 52 PAGE HANDBOOK ON BARREL FINISHING SENT ON REQUEST.

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Subsidiary of KING-SEELEY Corporation

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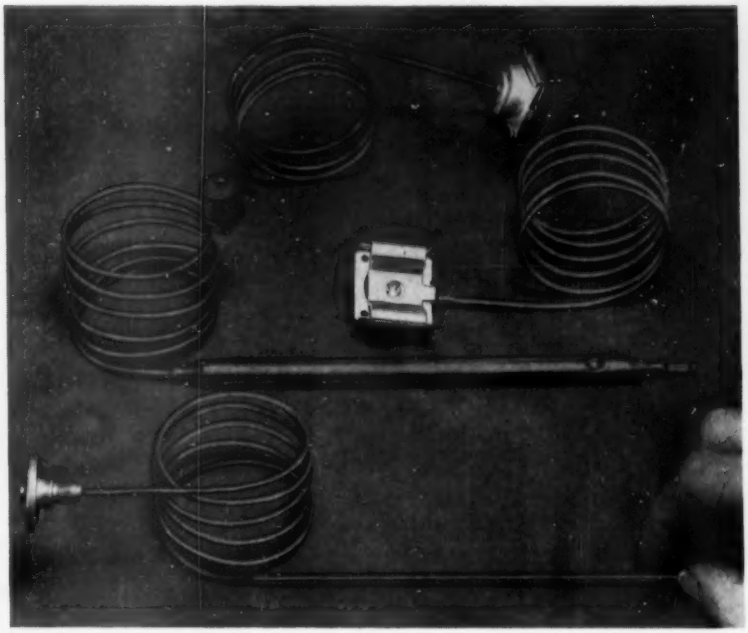
10 TO 15 NEW JOBS a week, each a different application, require a continuous program of evaluating the properties of metals and fabricating costs at Robertshaw-Bridgeport.



In making bellows (left) and temperature sensors (above) to meet ever-changing needs of control, appliance, and industrial equipment manufacturers, Bridgeport Thermostat Div., Robertshaw-Fulton Controls Co., Milford, Conn., averages 10 to 15 new problems a week. Specifications vary widely in dimensions and physical characteristics. Dependable performance over long periods of uninterrupted service is vital—yet costs must be rigidly controlled.

So for quality with maximum economy in fabrication, materials must be matched precisely to the needs of each job. And in this, Robertshaw-Bridgeport looks to its suppliers for creative technical services. For many years, The American Brass Company specialists have been helping to select the correct alloys in phosphor bronze or brass and to meet fabrication problems in the making of bellows—to apply economically precision-made capillary tubing and other small-diameter copper tube in sensor assemblies. Through such services, The American Brass Company is constantly helping metal fabricators across the nation control quality while keeping costs down.

ARE you caught between cost reduction and quality control? Find out if you are buying metal properties you don't need. An Anaconda specialist may be able to suggest a lower cost alloy that fits the requirements of your job more closely. Or he may find that an adjustment of temper or a change in your fabrication methods can cut your costs. The services of Anaconda specialists are available through your American Brass representative. Call him in today, or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 5807

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Everyone who subscribes to THE TOOL ENGINEER can look forward to receiving a very special bonus issue on June 15, 1959. The SUPPLIERS DIRECTORY ISSUE will present the industry's most complete and up-to-date guide to product information sources available anywhere. Whenever a tool engineer needs to know more about the specifications, prices, availability or functions of a given product, the SUPPLIERS DIRECTORY will guide him to the nearest *local* source of such information. As an issue of THE TOOL ENGINEER, the Directory will not be lacking in technical editorial content. Articles are planned to include such topics as Cost Estimating and Numerical Coding of engineering products. And, all of this will be provided at no additional cost.

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AN INVITATION TO AUTHORS

Authors of technical papers are invited to submit them for presentation at the fall, 1959 meeting of the American Society of Tool Engineers at St. Louis, Missouri, October 7 - 10. The program is sponsored by the ASTE National Program Committee.

This is an opportunity for authors to promote the growth of tool engineering knowledge and, at the same time, obtain national recognition for their contributions.

All technical papers are printed and widely distributed by the Society, giving them lasting reference value. In addition, many of the most outstanding papers are published in the Society's magazine, THE TOOL ENGINEER, generally recognized as the most authoritative magazine in its field.

The papers may deal with any field of tool engineering. ASTE membership is not required for submission of a paper. Papers will be accepted for consideration until March 31, 1959. Outlines should be sent to:

L. S. Fletcher
Program Director
American Society of Tool Engineers
10700 Puritan Avenue
Detroit 38, Michigan

Authors of accepted papers will be notified by April 15, 1959.

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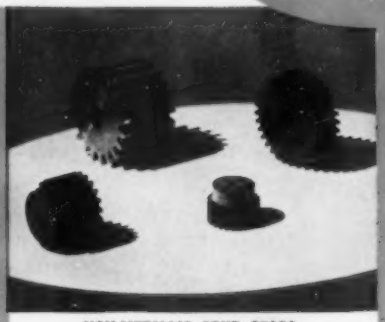

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HELICAL GEARS
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— STANDARDIZATION PAYS —

HY-PRO specialized tap engineering tells you

which tap where

for lowest cost per hole

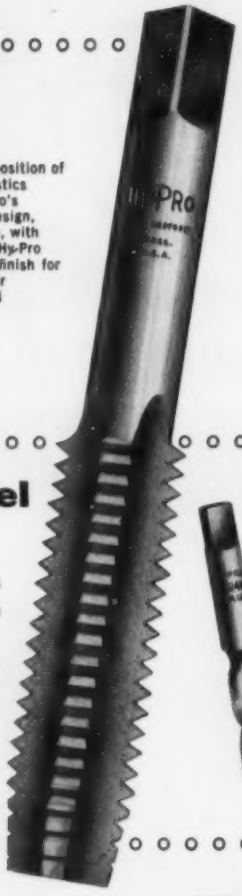
New alloys, new plastics, new tooling set-ups, and mounting production demands pose new problems daily in tap selection and use. HY-PRO tap engineering service provides prompt answers . . . the *right* answers that mean steady savings in tap expense, in time loss on the line, in reduced parts spoilage.

In plastics

Abrasive composition of most hard plastics requires Hy-Pro's multi-fluted design, .0025 oversize, with the exclusive Hy-Pro "Hardernell" finish for maximum wear resistance and free-cutting.

In die castings

Relative softness of alloys used causes tendency to close in and bind the tap. Hy-Pro's 2 flute spiral point oversize design meets these conditions, — provides free-tapping, clean threads.



In stainless steel

Hy-Pro spiral point design provides high-hook angle for most efficient cutting of this metal, and maximum tap strength. Ferrox surface treatment counteracts chip welding.

In aluminum

Hy-Pro's spiral (1) flute tap lifts chips out, gives best results in blind holes. Hy-Pro's spiral point design (2) is recommended for through holes. Chrome plate or nitride surface treatment resists abrasive effect of most aluminum alloys.

HY-PRO

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TAP ENGINEERING SPECIALISTS

What's your tapping problem?

Hy-Pro Tap Engineering Specialists can help you correct tapping troubles — and can often point out opportunities to cut costs in tapping operations you've considered satisfactory. It costs nothing to consult Hy-Pro Specialists, and records prove that in 8 out of 10 cases, their advice will pay steady dividends in savings. Write or phone: Hy-Pro Tool Company, Dept. C, New Bedford, Mass.

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FOR STANDARD TAPS FROM STOCK
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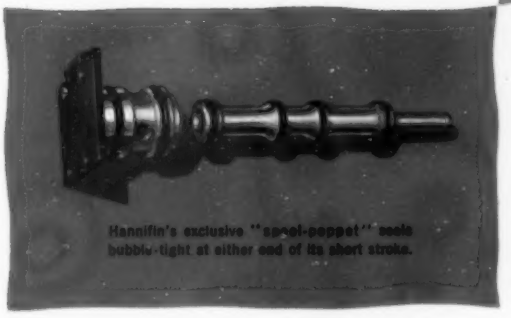
PARKER-HANNIFIN FLUID-SYSTEM COMPONENTS

From HANNIFIN... unit construction to give you air valves that do more jobs

Hannifin ⅜" four-way valve with "universal" base and new Speed Control section. Single-solenoid actuated, 10 other actuators available.



Hannifin's exclusive "spool-poppet" seals bubble-tight at either end of its short stroke.

For complete J.I.C. compliance, valve is electrically inoperative until dust-tight, splashproof solenoid cover is replaced and fastened tightly. Result: no more clogged, jammed solenoids.

One of the versatile—and most popular—Hannifin air control valves is this "CC" series, single-solenoid model. It is available for either ¼" or ⅜" air lines and is gasket-mounted to its own base. This particular base (one of three choices offered) can either be O-ring gasketed to your manifold or mounted over an opening in your bracket or machine. It will receive all four lines from below or take the inlet line from below and the two cylinder lines out one side. Or, you can make all connections at the sides.

When it comes to actuation, Hannifin offers an even wider selection: hand, foot, cam, pressure, single or double solenoid.

When necessary, you can remove this entire valve from its base without disconnecting air lines. Or, the exclusive "spool-poppet" can be replaced without even breaking electrical connections.

The "CC" series, like all Hannifin valves, is designed with "full flow" internal passages as large or larger than its rated pipe size.

You will find these and most other Hannifin valves described in Hannifin's new "Valve Finder." Get your copy from your Hannifin man, listed in the A-Z volume of Thomas' Register, or write:

HANNIFIN COMPANY
525 South Wolf Road • Des Plaines, Illinois

A DIVISION OF PARKER-HANNIFIN CORPORATION

***Experience**—the added alloy in **Allegheny Ludlum** tool steels*

Careful addition of sulfur to melt guarantees typical sulfide distribution, as shown in photomicrograph of longitudinal specimen of EZ MACHINING tool steel.

Sulfur addition to melt held to narrow range in Allegheny Ludlum's EZ MACHINING GRADES

Uniform, finely-distributed sulfides mean uniform machining, uniform high finish, uniform long tool life order after order

Adding sulfur, actually an impurity, to a tool steel melt to make it free-machining must be done with care and precision. That's why Allegheny Ludlum maintains an extremely close average range in adding sulfur to its EZ MACHINING grades. But mere range, however narrow, is not enough. A-L has developed special techniques in adding sulfur and nucleating agents to produce the uniform, finely-distributed sulfides that characterize good free-machining tool steels.

A-L's extra care means you can standardize your machining operations from piece to piece and order to order. This reproducibility is reflected in uniform *machining;* uniform *high finish;* uniform *long tool life.*

For example, in the production of hobs these machining properties in Allegheny Ludlum's EZ MACHINING steels minimize the costly "backing off" operation for back clearance of multiple teeth, eliminating complicated extra heat treatment. Lower residual stresses are set up, because the steel has a lower resistance to the cutting action. Naturally, hobbing is only one of the situations where these free-machining characteristics can benefit you.

Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier. *ALLEGHENY LUDLUM STEEL CORPORATION, Oliver Building, Pittsburgh 22, Pa. Address Dept. TE-15*

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Tool Steel warehouse stocks throughout the country .. Check the yellow pages

every grade of tool steel ... every help in using it

Truarc Retaining Rings, the engineered fastening method for reducing material, machining and assembly costs

function		for axial assembly				for taking up end-play					
						axial assembly				radial assembly	
nomenclature		basic		inverted		bowed		beveled		prong-lock®	bowed e-ring
											
series no.		5000	5100	5008	5108	5001	5101	5002	5102	5139	5131
application		Internal for Housing Bores	External for Shafts	Internal for Housing Bores	External for Shafts	Internal for Housing Bores	External for Shafts	Internal for Housing Bores	External for Shafts	External for Shafts	External for Shafts
range	in.	.250-10.0	.125-10.0	.750-4.0	.500-4.0	.250-1.456	.188-1.438	1.0-10.0	1.0-10.0	.094-.438	.110-1.375
	mm.	6.4-253.8	3.2-253.8	19.0-101.5	12.7-101.5	6.4-37.0	4.8-36.5	25.4-253.8	25.4-253.8	2.4-11.1	2.8-35.0

function		for radial assembly				self-locking types					
nomenclature		crescent®	e-ring	reinforced e-ring	interlocking	circular self-locking			triangular self-locking	triangular nut	grip-ring
											
series no.		5103	5133	5144	5107	5005	5115	5105	5305	5300	5555
application		External for Shafts	External for Shafts	External for Shafts	External for Shafts	Internal for Housing Bores	External for Shafts	External for Shafts	External for Shafts	With Threaded Screw	External for Shafts
range	in.	.125-2.0	.040-1.375	.094-.438	.469-3.375	.312-2.0	.094-1.0	.094-1.0	.062-.437	•	.077-.755
	mm.	3.2-51.0	1.0-35.0	2.4-11.1	11.9-85.7	7.9-50.8	2.4-25.4	2.4-25.4	1.55-11.1	•	•

GENERAL DESIGN PRINCIPLE: Tapered construction permits rings to maintain constant circularity and groove pressure.

Series 5000 and 5100: Basic types for axial installation. Rings provide optimum groove strength.

Series 5008 and 5108: Best clearances. Accommodate parts having large corner radii or chamfers.

Series 5103: Best clearances. Secure against moderate impact, vibration.

Series 5133: Provides high coupling shoulders; accommodates wide groove tolerances. Easy servicing.

Series 5144: Reinforced E-ring. Five times more gripping strength, 50% higher RPM limits than standard E-rings.

Series 5107: High impact resistance; high coupling shoulders. Accommodates extremely high rotation and relative parts rotation.

Series 5001 and 5101: Resilient end-play take-up. Accommodate wide tolerances. Recommended for pre-loading bearings.

Series 5002 and 5102: Rigidly locked end-play take-up. Recommended for locking one race of parallel bearing assemblies.

Series 5139: Rigidly locked into position by protruding locking tabs. Provides high resilient end-play take-up with sliding tabs for uniform flexure. Cannot be forced from groove without destroying ring. Accommodates relative parts rotation. Equally effective with round, square, rectangular or hex shafts.

Series 5131: Provides high take-up. Recommended where clearances are a major problem.

Series 5005, 5115, 5105 and 5305: Prongs dig into shaft, locking rings against movement in one direction.

Series 5300: Spring tension locks parts assembled with threaded screws.

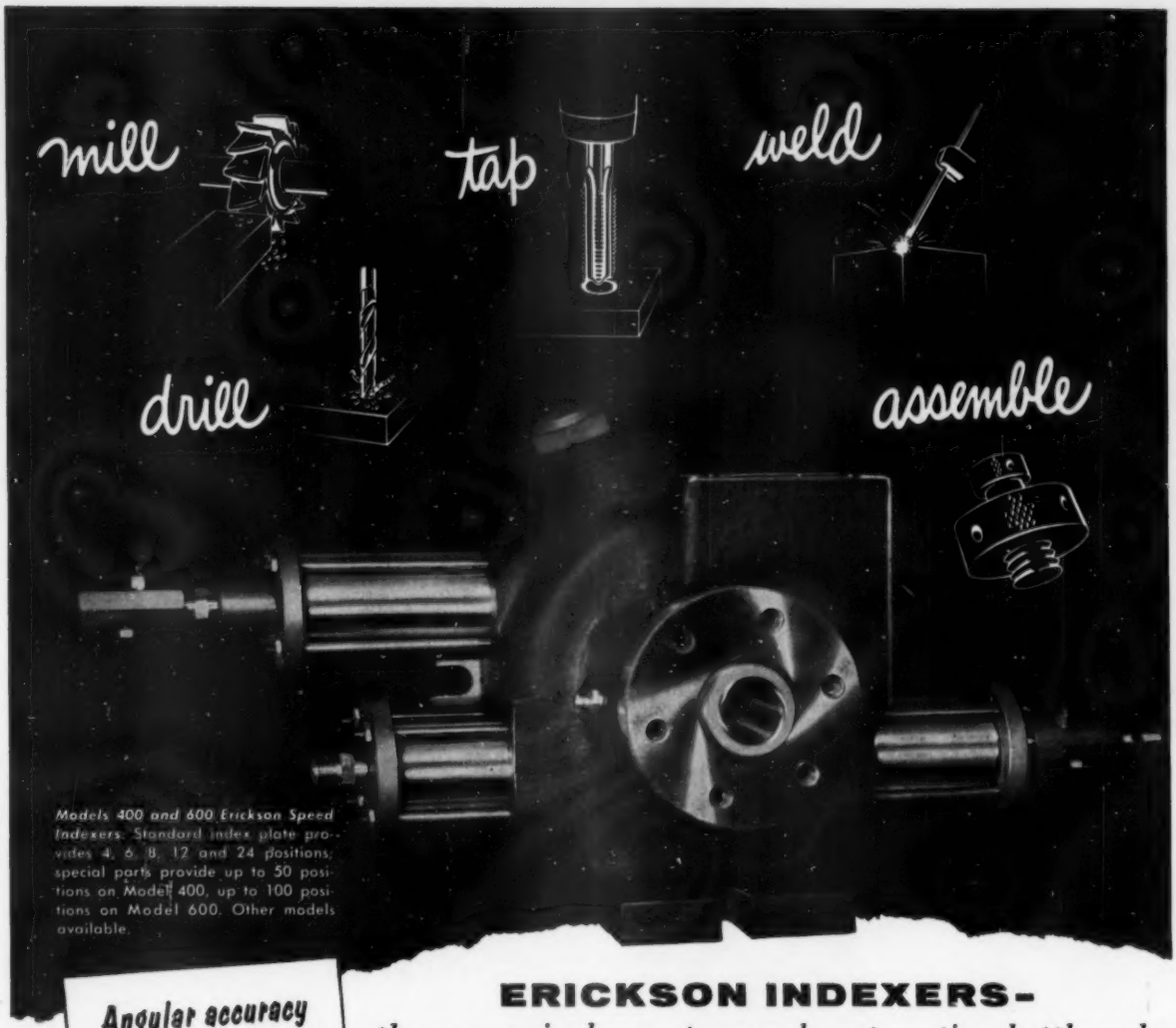
Series 5555: Self-locking against movement in either direction by spring tension. Since no groove is required, ring is adjustable to any position on shaft.

Waldes Truarc Retaining Rings are modern fasteners that solve a wide variety of design and production problems. Send for your new 24-page Catalog RR 10-58.

9.4

WALDES TRUARC® RETAINING RINGS

Waldes Kohinoor Inc., Long Island City 1, N. Y.



Models 400 and 600 Erickson Speed Indexers. Standard index plate provides 4, 6, 8, 12 and 24 positions; special parts provide up to 50 positions on Model 400, up to 100 positions on Model 600. Other models available.

Angular accuracy within 2 minutes... repetitive accuracy in low "tenths" of a thousandth

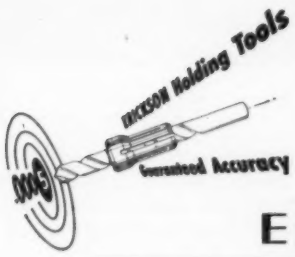
ERICKSON INDEXERS–

the economical way to smash automation bottlenecks

Even the most elaborate automatic production line can bog down *expensively* without rapid and accurate automatic parts positioning.

That's where Erickson Indexers really pay off. For you can interlock them into your production set-up with micro switches and solenoid valves. The hardened and ground lock pin operates in conjunction with the actuating mechanism to assure *positive positioning and angular accuracy within 2 minutes of a degree.* (Repetitive accuracy is no indication of angular accuracy. Erickson holds repetitive accuracy in low "tenths" of a thousandth.) And Erickson Indexers can maintain this great accuracy because their adjustable, self-contained shock control unit delivers a cushioned rotary load to the mechanism, thereby reducing wear.

Speed to keep lines moving . . . accuracy to reduce rejects . . . long life to cut maintenance and capital investment – all add up to Erickson Indexers, the *economical* way to smash automation bottlenecks.



Write for Erickson Catalog K today! You'll find many interesting applications for all Erickson holding tools. Take advantage of our free engineering service. An Erickson field engineer will gladly work with you for production economy.

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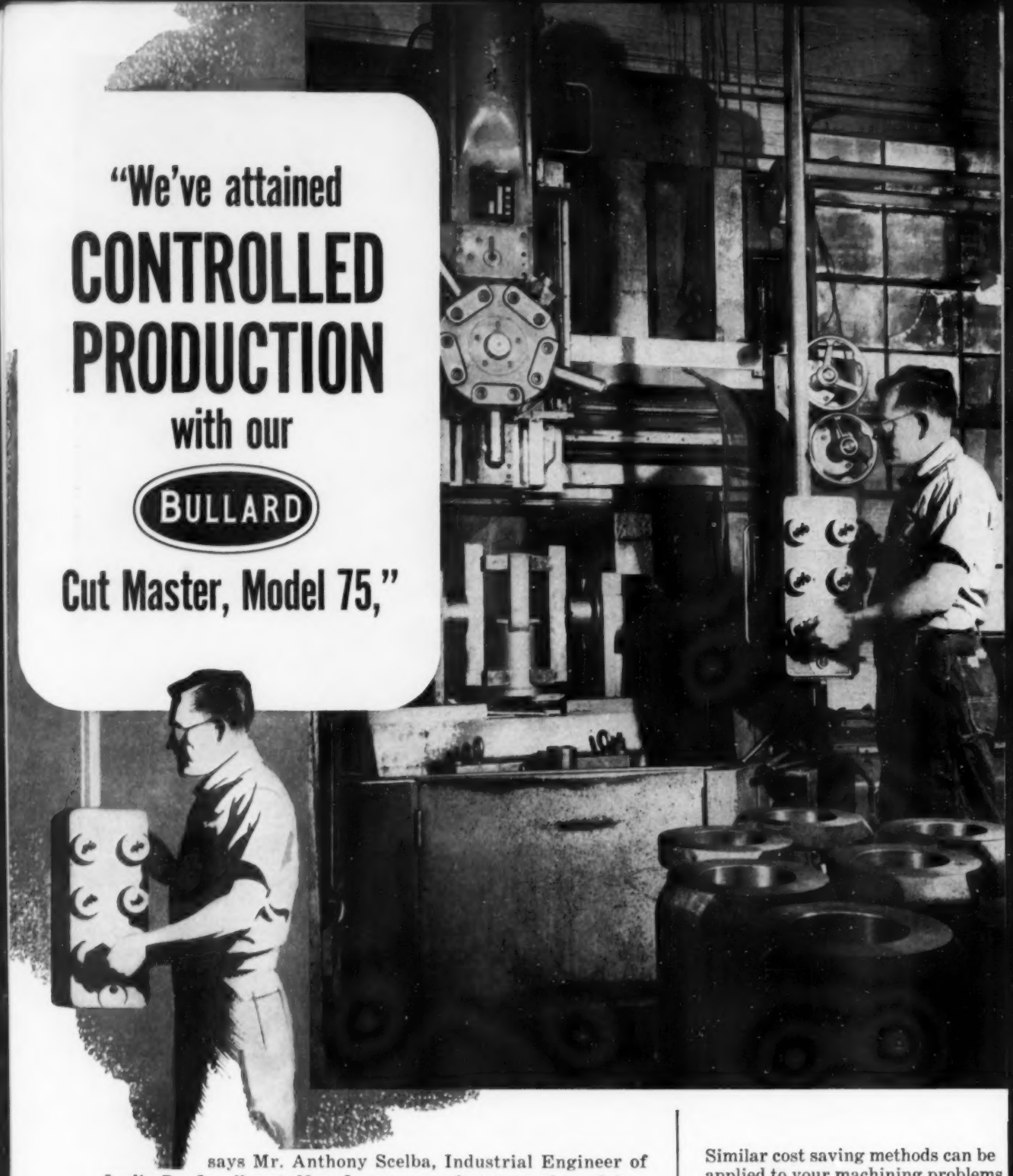

"We've attained CONTROLLED PRODUCTION with our BULLARD Cut Master, Model 75,"

says Mr. Anthony Scelba, Industrial Engineer of Leslie Co., Lyndhurst, New Jersey, manufacturers of regulators and controllers for industrial and marine steam systems.

Combining a specially designed indexing fixture, which permits indexing the piece in increments of 45° and with the automatic features of Cut Master, every piece leaving the machine is completely finished on all surfaces. This reduces the number of set-ups, for instance, on a four way valve from four set-ups to one. In this manner, production is controlled and a minimum inventory required.

Similar cost saving methods can be applied to your machining problems just call your nearest Bullard Sales Office or Distributor.

THE BULLARD COMPANY
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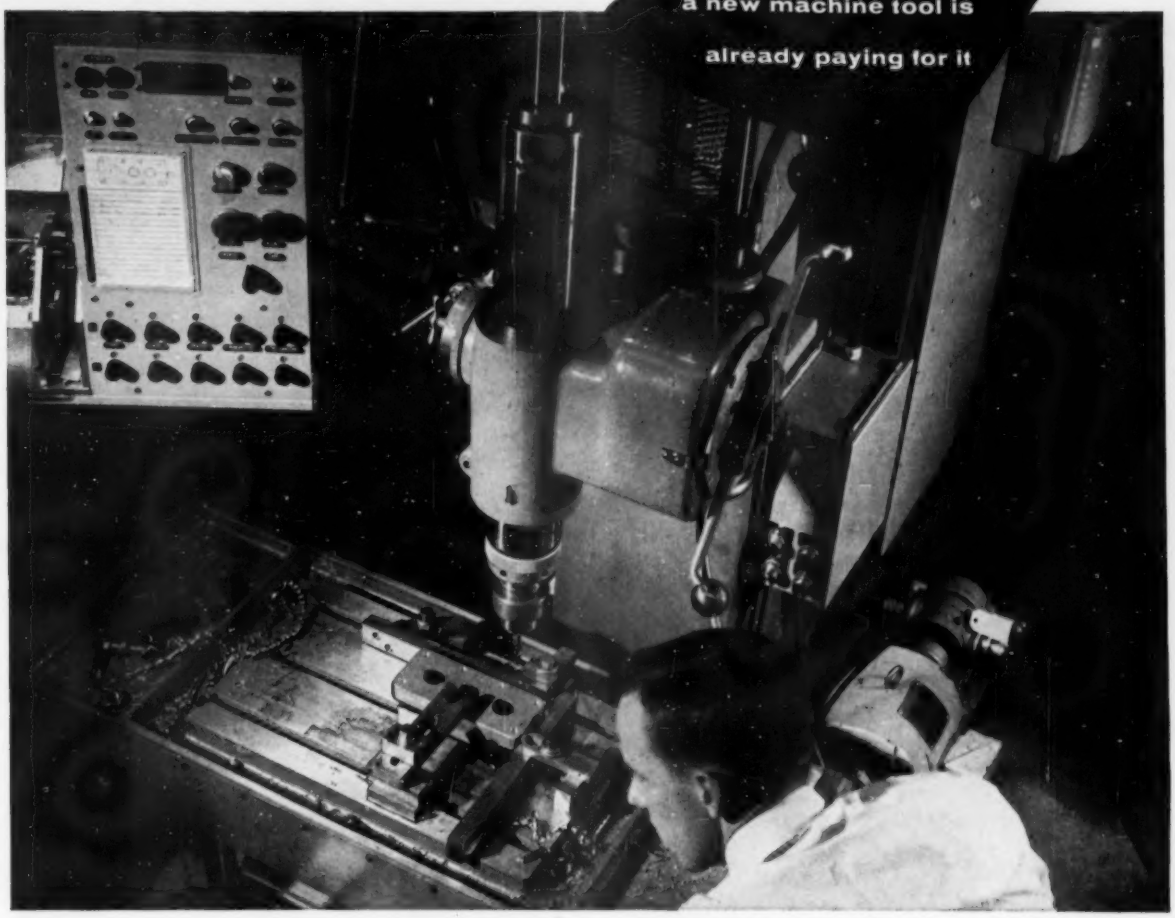
JONES & LAMSON "AUTOMATION"

the man who needs a new machine tool is already paying for it



Numerical control positioning eliminates jigs – saves time

The J&L Numerically Controlled Positioning Table quickly and accurately positions work pieces to an accuracy of ±.001″ — without jigs. And it can do it economically with any lot size down to a single piece.

For instance: in one installation, where precision parts previously had been machined on a conventional spacing table, J&L's new equipment achieved cycle time savings of six minutes per piece and set-up savings of over 116 minutes per set-up, or a total savings of 6.95 hours on a lot of 50 pieces.

In another plant, the cost of building $4,000 worth of jigs was eliminated during the first six weeks of operation. And in still another operation, the positioning table not only reduced set-up and cycle time, but also eliminated the storing, handling and maintenance of $29,000 worth of jigs.

You can get in on this kind of savings too. Write to Jones & Lamson Machine Company, 518 Clinton Street, Springfield, Vermont.

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Take advantage of Curtiss-Wright Custom Systems for

ULTRASONIC INSPECTION

LOWEST COST
in any specific application...

EASIEST OPERATION
and maintenance...

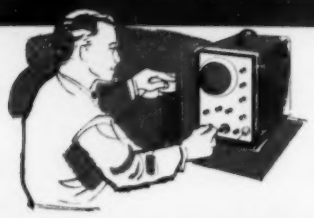
MAXIMUM PERFORMANCE
in resolution, linearity and dynamic range

Ultrasonic testing can speed your production, lower your costs, and save valuable time now wasted machining raw materials which later turn out to be defective.

But there are important *differences* in ultrasonic equipment now on the market.

To get the maximum in inspection performance, with the maximum economies —both immediate and long range—you will find that the Curtiss-Wright *custom system* is ideal for your application. This is because Curtiss-Wright studies your specific requirements . . . then tailors an inspection system for *your plant*. Curtiss-Wright has the organization, and the engineering talents, to provide you with exactly *what you need*. Investigate the advantages of this *custom system* planning.

Write, wire or phone for consultation with a Curtiss-Wright engineer today.



CONTACT TESTING. The Curtiss-Wright Echoscope® is a portable instrument for contact inspection for flaws in metals, ceramics and any other materials that conduct sound. Five operating frequencies—0.4 to 10 megacycles —meet specific requirements. Dependability and simplicity are stressed. A wide range of special attachments provide for individual applications, in line with the *custom system* philosophy which makes Curtiss-Wright ultrasonic equipment the most economical.

IMMERSION TESTING. The Curtiss-Wright Immerscope® is a quality control installation for laboratory or production use. Frequencies range from 2.25 to 25 megacycles. The Immerscope examines material and parts for flaws at any or all stages of production, locating and identifying defects according to both depth and relative size. The Immerscope is the basic component of a full-scale Curtiss-Wright system that can be applied to *your specific inspection requirements*. As a result, your investment and subsequent inspection costs can be significantly lowered.

PRINCETON DIVISION
CURTISS-WRIGHT
CORPORATION • PRINCETON, N. J.

Dept. 25, Princeton Division
Curtiss-Wright Corporation, Princeton, N. J.

Please send me, without obligation, literature on:

☐ The Echoscope ☐ The Immerscope ☐ Ultrasonic Testing

☐ Please have a Curtiss-Wright engineer call on me.

Name_____ Title_____

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Variety is the price of "Life" No single type of drill will give the longest wearlife under all operating conditions. One style is best for mild steels, another for plastics, another for tough stringy metals and so on. So it is wise to choose the particular type drill that will give longest wear-life and best results on each of your drilling jobs.

Besides the Jobbers Length drills shown here, GREENFIELD-AMPCO Drill Catalog No. 58 lists dozens of other styles...and lots of application information, too. WRITE FOR A COPY TODAY.

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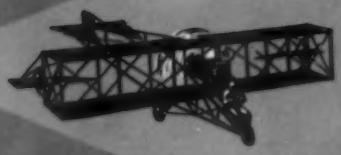

"Come, Josephine, in my flying machine" — and what a thrill it was to ride in one of those breezy sky buggies!

But, business today is going places in the luxurious comfort of swift, sleek modern air liners. At the same time many a "modern" shop is operating with flying machine era tooling!

From airplanes to earth satellites, modern products require modern tooling. No matter how good your die heads seem to be, if they are "back numbers", it will pay you to investigate new Geometrics. The Geometric man can show you how a new Geometric can improve your threading operations and lower your costs too.

CALL YOUR GEOMETRIC DISTRIBUTOR TODAY

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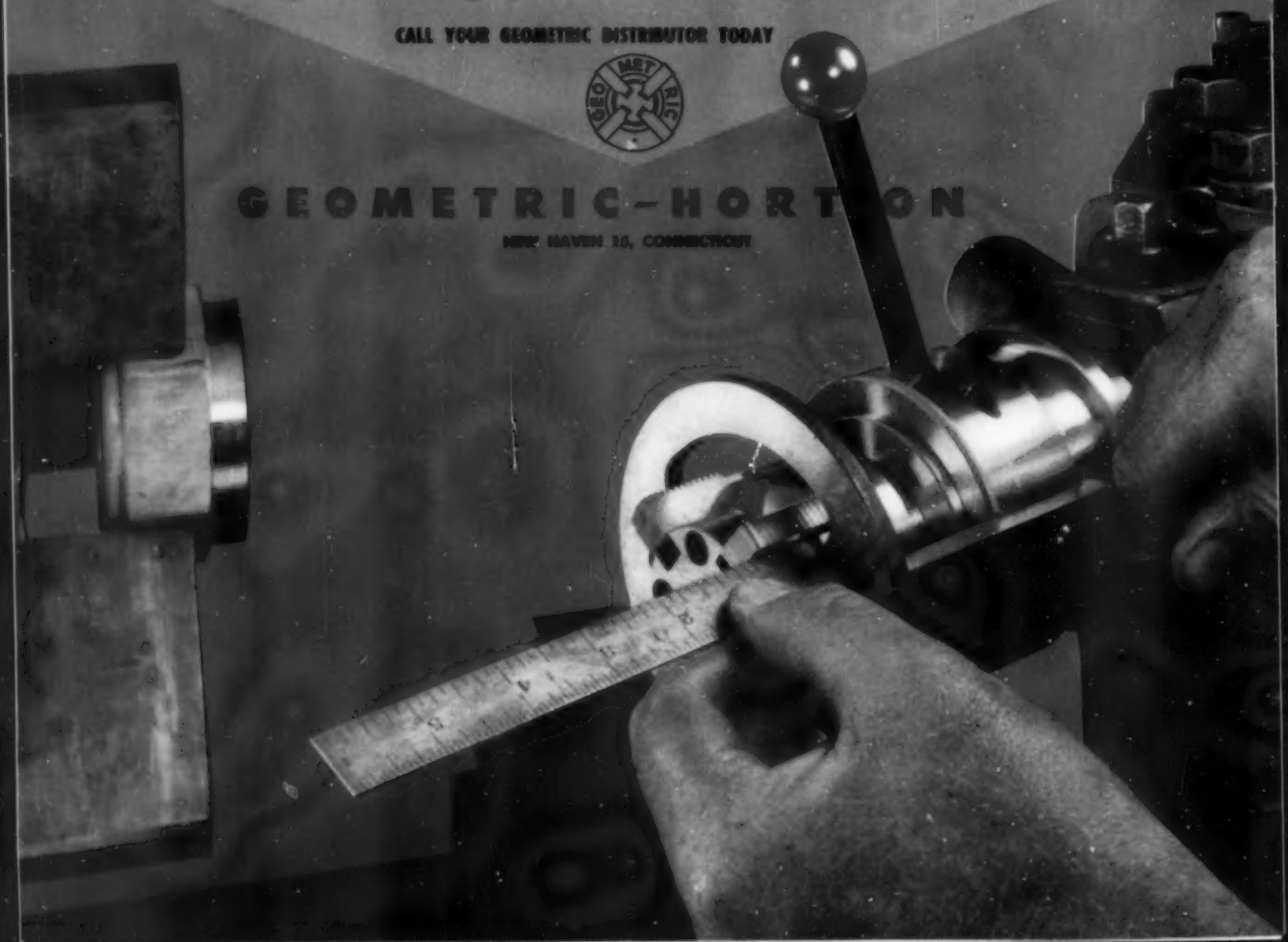
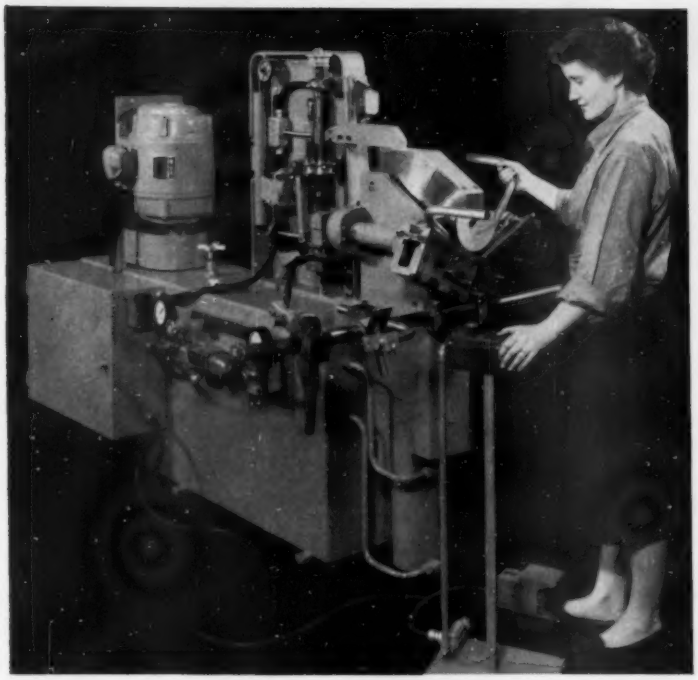


NEW PINES 3T PRESS

Cuts Bending Costs AS MUCH AS 50%



COMPLETE LINE OF BENDING PRESSES

In addition to the Model 3-T, Pines also builds the larger bending presses, illustrated below, which are also establishing outstanding performance records.

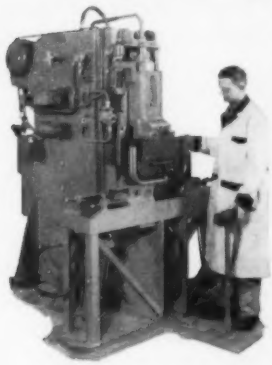
Makes Bends Progressively to Varied Angles In Multiple Planes 2 to 3 Times Faster

Quality bends at production speeds that are 2 to 3 times faster than conventional methods, are now possible with the new Pines 3-T Bending Press. Many tubular parts in sizes up to 1″ O.D. are now formed at net speeds of over 1000 bends an hour. Up to 9 different bend angles can be produced in a single setup. Adjustable automatic indexing stops accurately control depth of ram stroke. Open tooling area permits rapid progressive bending in varied planes.

Wing Die Design Assures Quality Bends

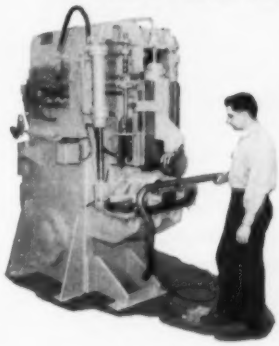
High production speed is just part of the story. Unusually smooth, good looking bends are produced to meet the quality demands of automotive, furniture, toy, office equipment, and appliance manufacturers. Wing dies of the press are designed to move in ways as a bend is made, and their pivoting action is hydraulically cushioned through bearing-mounted rocker arms. This principle eliminates scratches or draw marks and produces wrinkle-free bends with very little distortion. Get the complete story on cost cutting advantages of this new Bending Press today.

MODEL 6T FOR MULTIPLE U-FRAME BENDING



Makes two bends of the same or slightly different angles in each of two or more tubes simultaneously. Production of four or more bends with each stroke makes it possible to form 1700 to 3000 bends per hour in tube sizes ranging up to 1″ O.D. x .065″. When necessary, retractable ram dies are used to release pieces from die grooves. Like 3-T, wing dies move with work, eliminating draw marks, producing bends of superior quality.

MODEL 1900 FOR PROGRESSIVE BENDING OF TUBES UP TO 2″ O.D.



Designed for high speed bending of parts requiring a variety of bends in different planes, such as automotive exhaust and tail-pipes, or similar work. Major features are automatic angle indexing and greater working clearance which permits completing, for example, 90% of all bends in a tail-pipe with a single tooling setup. Press handles stock sizes up to 2″ O.D.

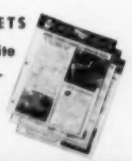
PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

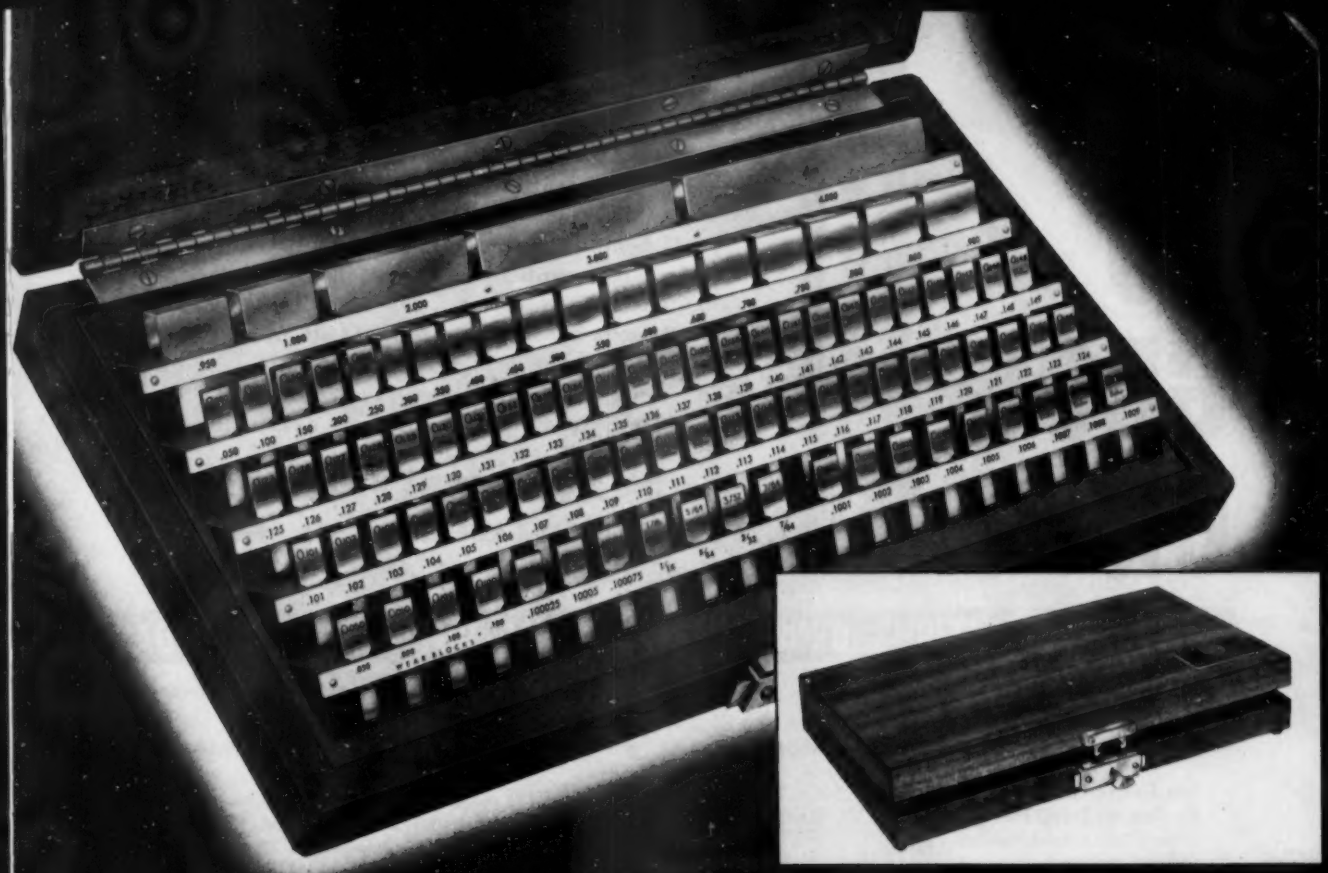
695 WALNUT • AURORA, ILLINOIS

WRITE FOR *FREE* DATA SHEETS

To keep abreast with bending, write for free copies of "Pines News"—get latest data on rotary and press-type machines, and up to date information on tooling.



PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY



THE CASE, also new and greatly improved, is made of finest quality, frosted walnut grain Melamine, with Bakelite interior. (Patent pending.)

Webber ANNOUNCES

A New Superior Gage Block, "A+" .000004 .000002

Priced lower than former "A" and "B" sets.

These new blocks actually exceed U. S. Bureau of Standards or Federal specifications for Grade "A" blocks. Yet WEBBER has priced them even lower than now obsolete "B" blocks!

A COMPLETE 84 block set only $287.50

including two .100 Croblox (chrome carbide) wear blocks.

New, HIGHER Accuracy

New, BETTER Case

New, LOWER Prices

Don't wait! Write today direct to WEBBER for your free copy of folder describing this REVOLUTIONARY BUY.

Webber GAGE COMPANY 12908 Triskett Road Cleveland 11, Ohio

Largest exclusive manufacturers of precision gage blocks

400 TO GROW ON

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DIE SETS HAVE

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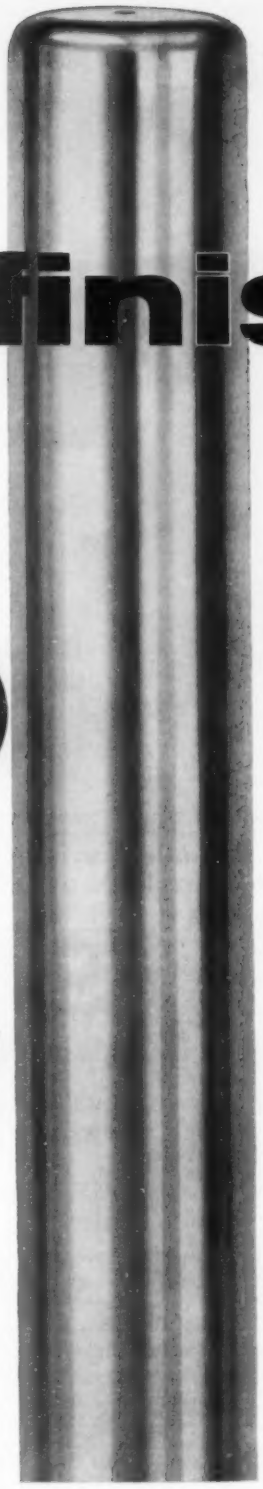
GUIDE PINS



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MAXIMUM SURFACE HARDNESS

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GREATLY REDUCES POSSIBILITY OF SCORING

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Super Finish eliminates charging which is common to pins lapped with an abrasive compound.

Super Finishing, long a prerequisite in the Automotive and Aircraft Industry for precision bearing surfaces, is now a standard on Superior guide pins. With Super Finished guide pins ideal clearances can be maintained due to a greater bearing surface.

Write for the NEW 28 page Superior Catalog Today!!

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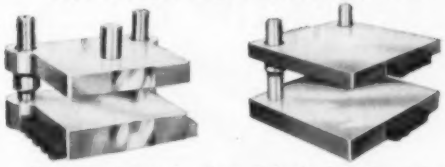

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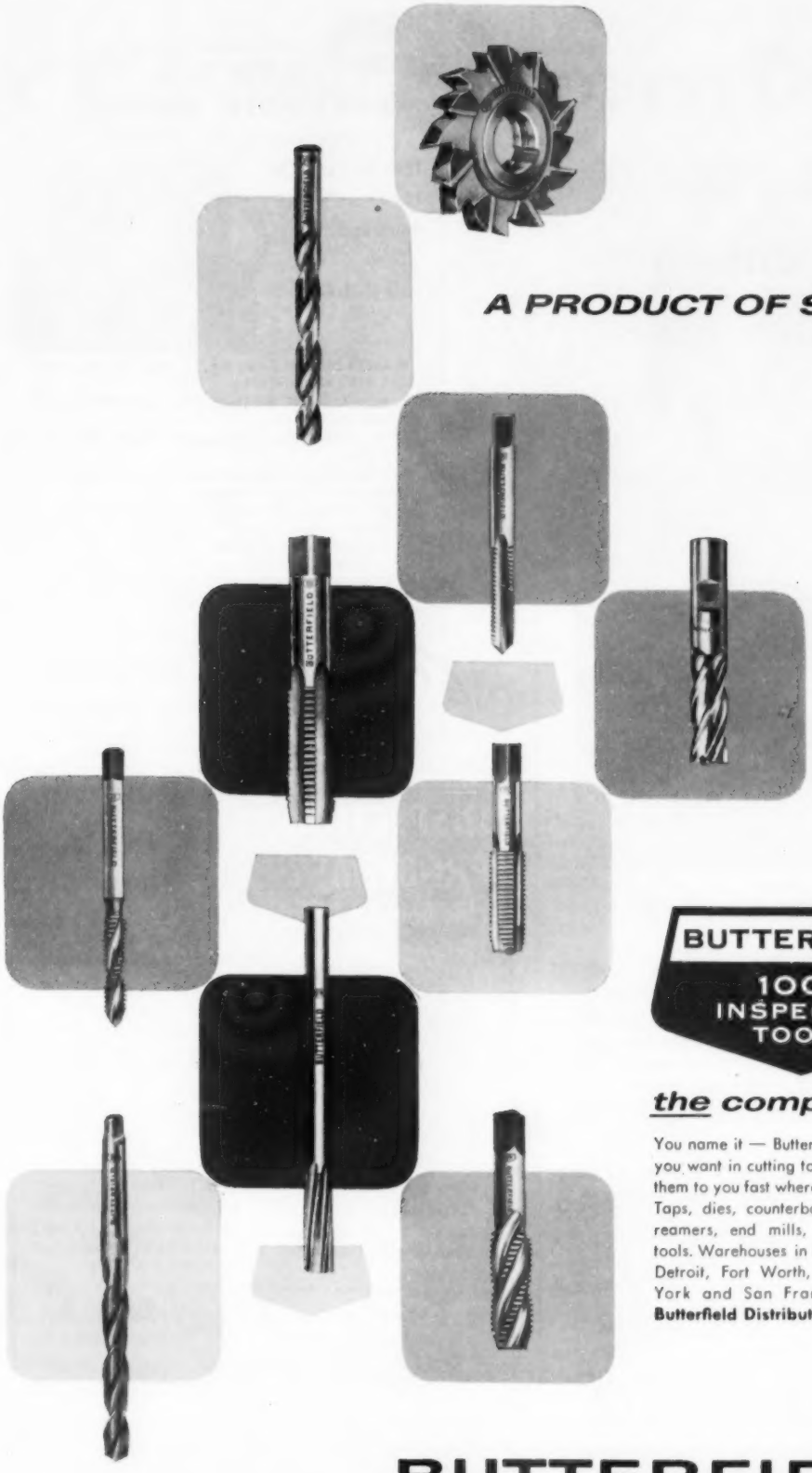

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100% INSPECTED TOOLS

the complete line

You name it — Butterfield has everything you want in cutting tools — and can get them to you fast wherever you want them. Taps, dies, counterbores, cutters, drills, reamers, end mills, hobs and carbide tools. Warehouses in Chicago, Cleveland, Detroit, Fort Worth, Los Angeles, New York and San Francisco. **See your Butterfield Distributor.**

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BUTTERFIELD DIVISION, UNION TWIST DRILL COMPANY, DERBY LINE, VERMONT

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It's NEW from DoALL

MORE USEFUL DIMENSIONS WITH FEWER GAGE BLOCKS

Only set 55-R offers decimal dimensions in .001″ increments from .020″, in .0001″ increments from .100″, and fractional dimensions by 1/64 increments from 1/64″.

Dimensions	38-Pc. Set	83-Pc. Set	55-Pc. Set
.028″ snap ring	No	No	Yes
.046″ snap ring	No	No	Yes
1/16″ keyway	No	No	Yes
.068″ snap ring	No	No	Yes
.086″ snap ring	No	No	Yes
3/32″ keyway	No	Yes	Yes
1/8″ keyway	No		

After 53 years—a gage block set for the shop

NEW 55-R SET PROVIDES WIDELY SPECIFIED DECIMAL AND FRACTIONAL DIMENSIONS NOT AVAILABLE IN TRADITIONAL SETS.

Selected by shop men, tested by shop use and checked by a poll of diversified industries, set No. 55-R is the first basic departure from the 81 piece inch series gage block set introduced 53 years ago. Now you can make common fractional dimensions and many others with just one or two blocks instead of the five or six from traditional sets. Greatly reduces time-consuming job of selecting, cleaning and wringing.

Keyway slot in gear simply and easily checked with single fractional block.

One block from .010″ series solves problem of checking O-ring groove on this shaft.

Saves you money, too!

The modest price of a 55-R set makes a worthwhile saving over the cost of larger sets. The life of a set of gage blocks is lengthened since fewer blocks are required to make up common dimensions. It is practical to assign a set to each of your toolmakers or machinists to eliminate time waste created by a group working from the same set. Call your local DoALL sales-service store for further information and literature, or write.

AVAILABLE IN THREE GRADES

AA Grade	+.000002″ −.000002″	—$490.00
A+ Grade	+.000004″ −.000002″	—$340.00
Shop Blocks	+.000006″ −.000002″	—$240.00

GAGE BLOCK SET NO. 55-R

.010″	(single block)	— .010″ series
.020″ through .029″	(10 blocks)	— .001″ series
.1001″ through .1009″	(9 blocks)	— .0001″ series
.101″ through .109″	(9 blocks)	— .001″ series
.110″ through .190″	(9 blocks)	— .010″ series
.100″ through .400″	(4 blocks)	— .100″ series
1.000″, 2.000″, 3.000″	(3 blocks)	— 1.000″ series
1/64″, 1/32″, 3/64″, 1/16″, 1/8″, 1/4″, 1/2″, 3/4″	(8 blocks)	— Fract. series

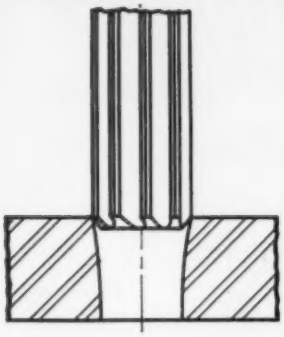
.050″ or .100″ Steel or carbide wear blocks optional

GB-30

The DoALL Company, Des Plaines, Illinois

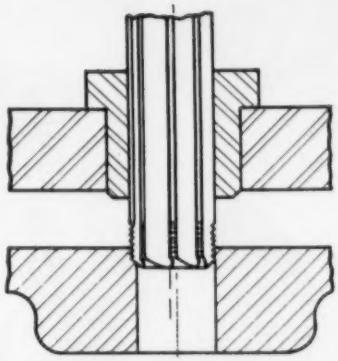
THIS IS A TYPICAL DoALL STORE

REAMING TIPS YOU CAN USE



When a hole is to be reamed, check handbook recommendations on size of drill to use. A reamer works best, and lasts longer, when there is adequate stock left for reaming. Avoid tapered or bell-mouthed holes (caused by improper drilling) that cause excessive reamer wear.

Protect reamers at all times. The chamfers or cutting edges and the accurately ground surfaces of the margins will be damaged if mishandled. Good shop practice is to save the sturdy tubes in which the reamers were originally packed. When not in use, keep reamer in its own labeled tube.



Misalignment between the reamer and the drilled hole can create two problems: 1. Wear on the reamer that takes the form of a thread . . . with depth equal to amount of misalignment; 2. Poor finish in reamed hole. *Always* check alignment of drilling and reaming fixtures.

FOR QUICK SOLUTIONS TO ALL YOUR DRILLING-REAMING PROBLEMS,
SEE CHICAGO-LATROBE CATALOG No. 58, OR CONSULT A C-L SERVICE ENGINEER

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For Every Cutting and Grinding Job

Whatever your metal removal needs, a Manhattan Abrasive Wheel can be engineered for your particular alloy requirements. Manhattan abrasive wheel specialists help solve problems at *your* plant . . . for cutting, rough grinding, and finishing steels, light metals and alloys. Every component of the wheel you specify—abrasive, grain size, hardness, structure and bond—is custom-designed to give you more output per man hour . . . more production for your abrasive wheel dollar.

Discuss your metal removal or cut-off requirements with a Manhattan Abrasive Wheel Specialist. He'll show you how to boost production, reduce costs, and help you determine the best Manhattan high speed, heavy duty abrasive wheels for your operations.

- REMOVE MORE METAL, FASTER . . . AT LOWER COST
- CUSTOM-BONDED FOR YOUR JOB
- CUTTING, GRINDING AND FINISHING TYPES
- FOR IRON, STEEL, LIGHT METALS AND ALLOYS
- LONGER WHEEL LIFE

"More Use Per Dollar"

RM9S1

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PUNCH LIFE INCREASED FROM 2,000 to 25,000 HOLES IN STEEL PLATE

These punches (11/16") were used to punch 25000 holes in ½", 1020 cold rolled steel plate. Without MOLYKOTE Lubricants a maximum life of only 2000 holes could be obtained.

A West Coast manufacturer was experiencing low punch life with the best conventional lubricants. Their multiple punching operation consisted of cold shearing 50 holes simultaneously in a single steel plate. A maximum life of 2,000 holes per punch was obtained with ordinary lubricants.

Then, MOLYKOTE Type G was applied to the punch occasionally. The result: punch life was increased from 2,000 to 25,000 holes which afforded substantial savings.

When writing, refer to Item 508

"A LITTLE BOTTLE FOR A BIG JOB"

- For Extending Die Life.
- For Preventing Metal Pickup.

Try it . . . Order a 10 ounce container of MOLYKOTE Type Z TODAY!

MOLYKOTE CANNOT BE SQUEEZED OUT REGARDLESS OF PRESSURES; EXCELS AS COLD-FORMING LUBRICANT IN METALWORKING

Distortion, Stick-Slip and Fretting Eliminated • Mounting Loads Reduced • Chatter and Noise Avoided • Allows Easier Disassembly

In metal forming the most difficult problem to overcome is scuffing from metal pickup on the dies. Direct contact of bare surfaces of a piece undergoing formation with the die often results in galling, scuffing, etc. If the surfaces can be separated by a lubricant of sufficient film strength, metal pickup does not occur.

Before new dies are used, burnish them with MOLYKOTE Type Z. If the lubricant you are now using does not have sufficient film strength and galling does occur, use MOLYKOTE on your dies.

The automobile industry which forms and fabricates vast tonnages of various metals, uses MOLYKOTE Type Z extensively.

When writing, refer to Item 505

Applying MOLYKOTE Lubricant to feed stock at the Bassick Company, Bridgeport, Conn., in a forming operation.

DAMAGE DUE TO IMPROPER MACHINERY "WEAR-IN" CAN BE ELIMINATED WITH NEW COMPOUND

Wear-in damage is often serious enough to require costly reconditioning of new equipment and if the damage is not repaired, it will interfere with and reduce the useful service life of expensive machinery. During this critical wear-in period, damage due to galling, scoring, tearing, scratching, excessive abrasion and seizing is an inherent hazard. MOLYKOTE WEAR-IN COMPOUND is the most effective lubricant yet developed to combat this damage.

In seven different ways, MOLYKOTE WEAR-IN COMPOUND saves you time and money:

1. **Shortens "wear-in" period without use of abrasives.**
2. **Reduces galling, seizing and excessive wear during the critical "wear-in" period in new or rebuilt machinery and after the installation of replacement parts.**
3. **Offers the best safeguard against costly reconditioning work and shipping delays due to the "breaking-in" of new machinery.**
4. **Eliminates "stick-slip" behavior and resists galling and seizing at bearing pressures far beyond the yield point of any metal.**
5. **Specifically designed for "wear-in" use. MoS_2 particles make intimate contact with bearing surfaces. Will not scrape off.**
6. **Need not be burnished into surface. Brush or wipe on a thin coating.**
7. **Inexpensive . . . a little goes a long way.**

When writing, refer to Item 506

Address your letter to The Alpha-Molykote Corp., 65 Harvard Ave., Stamford, Conn.
Phone: FIreside 8-3724.

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THE ALPHA-MOLYKOTE CORP.
Stamford, Connecticut
Please send me details on

Item 505 ☐ Item 506 ☐ Item 507 ☐ Item 508 ☐

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BREAKING LUBRICATION BARRIERS ...THROUGH RESEARCH

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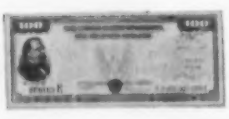
—and its thousands of employees who help strengthen America's Peace Power by buying U.S. Savings Bonds

The huge team that plans, builds and markets the cars America drives is making another great contribution to our national security. Thousands upon thousands of auto industry employees are buying U. S. Savings Bonds, regularly, through the Payroll Savings Plan.

Regular purchase of Shares in America helps these forward-looking people set up their own reserves for home building, for education and for greater security after retirement. The Payroll Savings Plan provides a sound, automatic way to practice thrift.

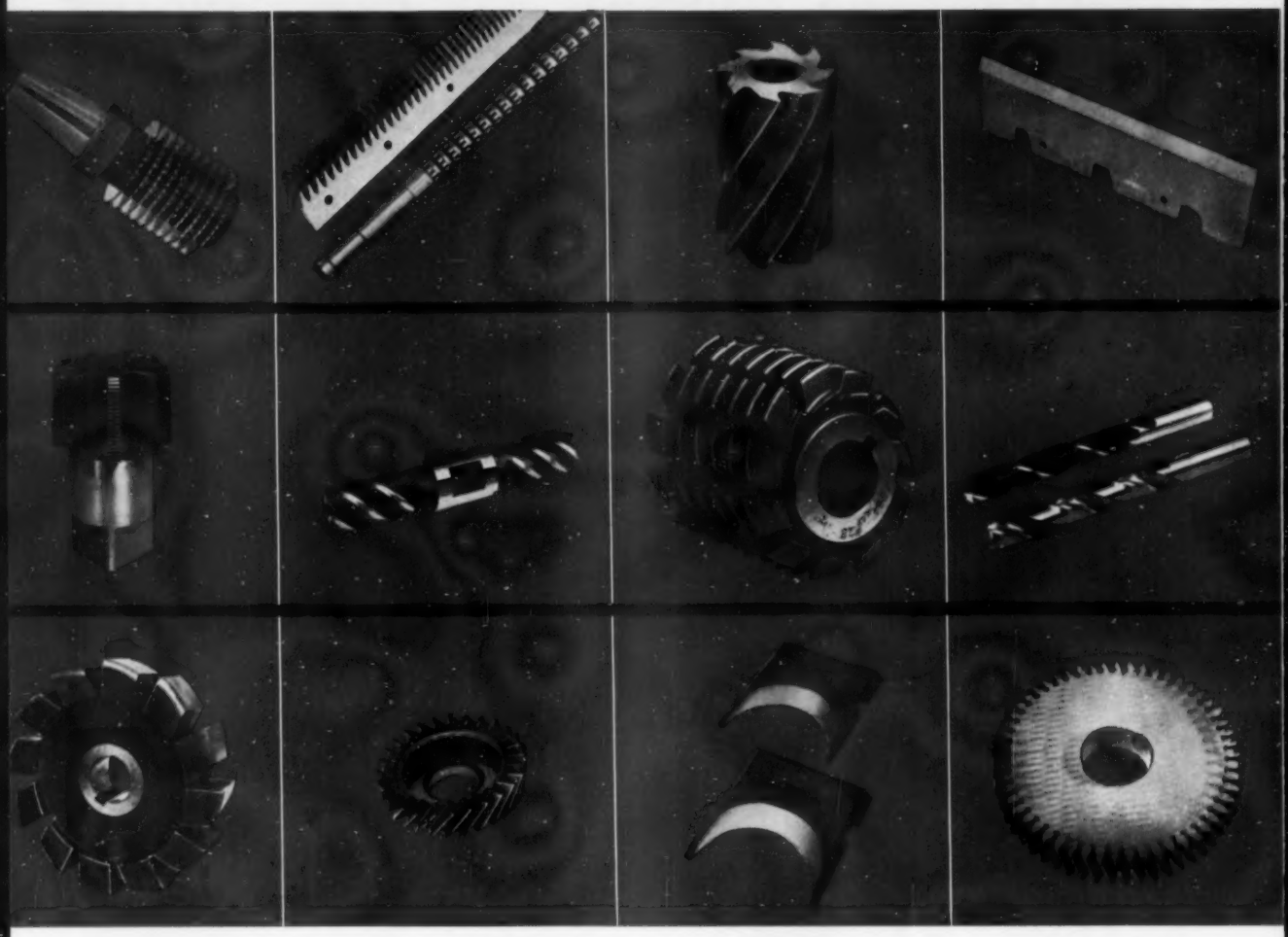
If your company has not yet put in a Payroll Savings Plan, start now. It's easy! Just telephone your State Savings Bond Director for the help he is eager to give you. Or write to Savings Bond Division, U. S. Treasury Department, Washington, D. C.

Henry V. Pogorzelski, pictured at work in one of America's great automobile plants, is typical of the thousands of skilled employees in this field who are buying U.S. Savings Bonds regularly. Mr. Pogorzelski uses his company Payroll Savings Plan to make his contribution to the Peace Power of his country.



American Society of Tool Engineers
10700 Puritan Avenue Detroit 38, Michigan

used almost everywhere . . . for almost everything!



America's staple high speed steel

VASCO M-2

This is the basic, utility high speed steel favored by toolmakers and toolmaking departments of industries throughout the country. Versatile, dependable VASCO M-2 is always readily available in standard and special rolled shapes, hammer-finished bars, blocks, disc and ring forgings, plate, sheet, discs and rings punched from sheet, drill rod, tool bits. Ground finish is obtainable on all items when desired. VASCO M-2 is also furnished in free-machining (FM) grade. Large stocks are maintained in principal manufacturing centers.

● *Write for technical Data Sheet.*

Made and guaranteed by the makers of famous

Red Cut Superior . . . Vasco Supreme . . . Neatro . . .

and many other FIRST QUALITY *high speed steels*

known and preferred throughout industry.

Vanadium-Alloys Steel Company

LATROBE, PENNSYLVANIA

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260 ways to "package" a pinch of powder

Metallurgical Products Department reports on a line of 260 locally-stocked Carboloy® cemented carbide inserts that slashes inventory and special-order costs

Carboloy cemented carbides start as metal powders – end as man-made metals in a variety of disposable inserts *unmatched* in the industry.

And that's where you save with Carboloy cemented carbides. You choose from 260 different inserts – 11 styles – 7 cutting grades – in any size, thickness, radius, or shape you need. You get an insert that's almost tailor-made for your particular job without costly special-ordering; and you get it *fast*, from a *local* distributor who carries your inventory *for you*.

All Carboloy cutting tools are stocked by your local Authorized Carboloy Distributor. Call him (see the Yellow Pages, under "Carbides"); or write: *Metallurgical Products Department of General Electric Company, 11101 E. 8 Mile Road, Detroit 32, Michigan.*

METALLURGICAL PRODUCTS DEPARTMENT

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Index of Advertisers

March 1959

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LOOKING AHEAD

By T. W. Black
Senior Associate Editor

Revolution in metalworking? Recent developments in automatic control of machining operations, plus innovations in forming methods, mark a giant step into the future.

Kearney & Trecker's recently announced "Milwaukee-Matic" combination machine is a case in point. This machine performs milling, drilling, reaming, tapping and boring operations under magnetic tape control. Up to 30 tools, stored in a revolving drum, are changed as directed by control tape.

Giddings & Lewis has developed a family of tape-controlled machines. Their latest development is a vertical turret lathe equipped with a "Numeripoint" control system. This is a dual-purpose machine, operated manually or from punched paper tape.

About three-quarters of all manufacture in this country involves production lots of 25 or fewer units. Tape control provides the flexibility of the manually operated line with the dependable low-cost production of an automated line.

Giddings & Lewis executives feel that tape control provides one answer to the problems faced by American industry in competing with foreign companies that are able to exploit low labor rates. They point out that tape control fits the needs of the machine tool industry and add: "We expect to take a lot of this medicine ourselves."

High-velocity extrusion and forging are other metalworking innovations that have reached production stages. Engineers at Convair's Dynapak Div. have succeeded in extruding tungsten, previously considered impossible. The extrusion dies are of tool steel but, due to the speed of extrusion (one ten-thousandth of a second), there is no tendency for dies to heat up or score.

Five Russian engineering educators who recently visited American universities feel that American students do not acquire the same degree of technical proficiency as Russian students.

At the same time, some American educators feel that American engineering students need a broader general education. James C. Zeder, president of the Chrysler Institute of Engineering, says: "Professional education must go beyond specialized technical knowledge alone —it must extend into the broad understanding, insight and perspective that has been historically associated with liberal education."

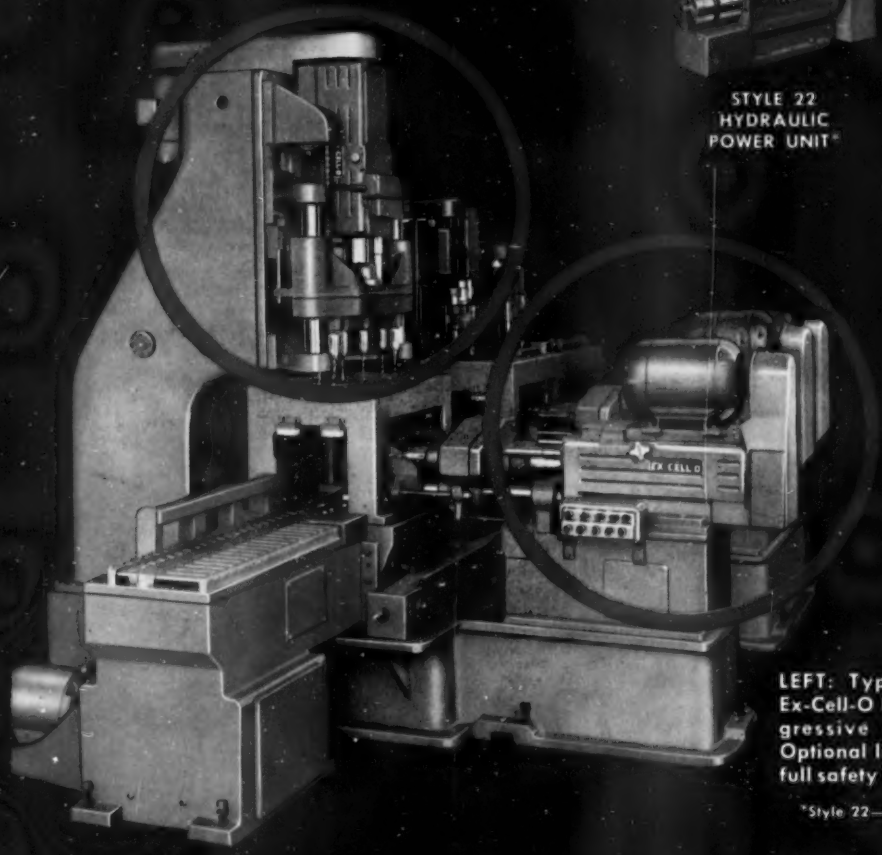
We would be interested in reader comments on whether students should receive training in liberal arts at the expense of engineering courses. Frankly, we don't have any pat answers.

XLO EX-CELL-O FOR PRECISION

STYLE 22
HYDRAULIC
POWER UNIT*

STYLE 28-A
HYDRAULIC POWER UNIT

STYLE 20
HYDRAULIC POWER UNIT



LEFT: Typical application shows six Ex-Cell-O Power Units installed on a progressive transfer-type machine tool. Optional limit switch assemblies provide full safety interlock and start-cycle control.

*Style 22—8-inch Stroke; Style 22-L—12-inch Stroke

POWER + VERSATILITY

58-11

With Ex-Cell-O Quill-Type Hydraulic Power Units

Why buy a power unit that's made to do just one job—when a single, low-cost Ex-Cell-O Hydraulic Power Unit will do more work in a broad range of applications?

Compact Ex-Cell-O Power Units are used for drilling, spot-facing or reaming in special-purpose machines. When these operations are no longer desired, the units can be quickly and easily relocated to perform numerous other operations.

Because of their simple, precise control in automatic cycling, they've even been used in light, high-production broaching, material handling and many unrelated operations.

Ex-Cell-O Hydraulic Power Units are self-lubricated, perform in fast cycles, and are easy to install, particularly where space is at a premium.

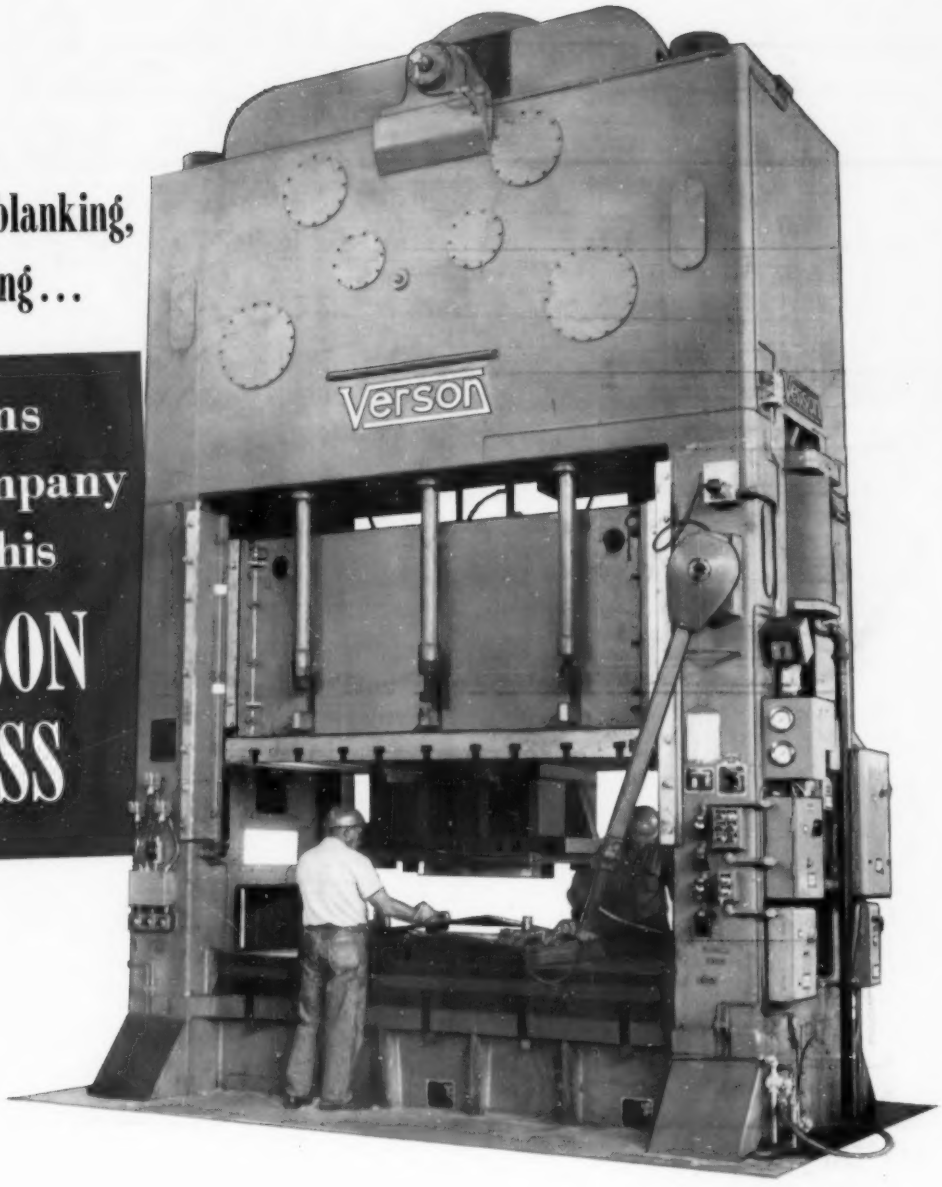
For complete information on Ex-Cell-O Quill-Type Power Units, and how they can lower your production costs, call your local Ex-Cell-O Representative or write direct.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN
Machinery Division

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

For punching, blanking, forming, drawing...

Lukens Steel Company uses this VERSON PRESS



Here's another example of the versatility of Verson Presses. This 600 ton eccentric, installed at Lukens Steel Company, Coatesville, Pennsylvania, performs a wide variety of work. Punching . . . blanking . . . forming . . . drawing . . . the Verson Press handles them all.

This machine has a 14″ stroke with 10″ power adjustment of the slide. Area of the slide and bolster is 54″ x 108″. The press operates at 14 SPM and has a drawing speed of 51 FPM. A Verson Cascade lubrication system automatically supplies oil to all lubrication points on the press. Should a lubrication failure occur, the press is stopped automatically.

Big job . . . small job . . . there is a Verson Press to meet your needs. When requirements call for great versatility . . . men who know presses . . . depend upon Verson. Whatever your requirements, it will pay you to talk to Verson first.

A Verson Press for every job from 60 tons up.

210-C

Verson

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